

SMALL SHOP JOURNAL: BUILD A BASIC LADDERBACK CHAIR (page 68)

WOODWORKER'S JOURNAL

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How to Make a **ROUND** Tenon on a **SQUARE** Leg

(page 72)

INSIDE:

The Comb Hinge
Ladies' Desk
Mortising Stand
Dovetail Puzzle Box



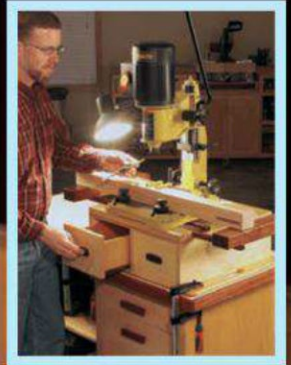
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- Min. stock length: 8"
- Max. cutting depth: 1/8"
- Feed rate: 16 FPM & 30 FPM
- Cutterhead speed: 5000 RPM
- Approx. shipping weight: 662 lbs. (G0453P) 666 lbs. (G0453PX)



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- Min. stock length: 8"
- Max. cutting depth: 1/8"
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- Approx. shipping weight: 920 lbs.



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- Cutting cap/throat: 13 1/2"
- Max. cutting height: 6"
- Overall size: 67 1/2" H x 27" W x 30" D
- Footprint: 23 1/2" x 16 1/2"
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- Approx. shipping weight: 246 lbs.



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- Motor: 1 HP, TEFC, 110V / 220V single-phase, 1725 RPM
- 4" dust port
- Cutting capacity/throat: 13 1/2"
- Max. cutting height: 6"
- Overall size: 66 1/2" H x 26 3/4" W x 30 1/4" D
- Precision-ground cast iron table size 14" x 14"
- Table height: 43 3/8"
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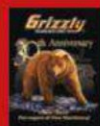
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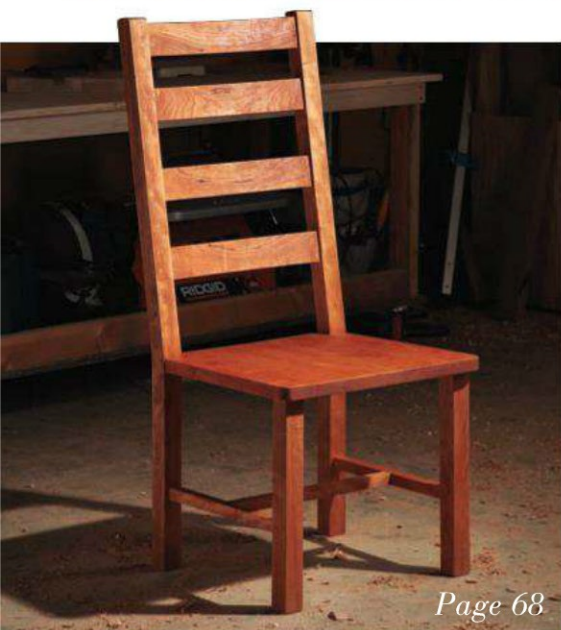
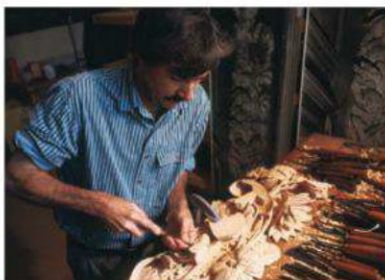
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Letters

Considering the Cost ...

LUMBERING ALONG WITH WOOD CHOICES ...

The cost of lumber is always a topic that sparks conversation among woodworkers. Personally, I lean towards spending a little extra to get a great-looking piece of wood, because I think it pays dividends when people look at my work. (I somehow get credit for growing the tree so prettily!) But lumber can be expensive, and we woodworkers are a “thrifty” lot. So in the next few issues, the *Journal* will look into finding lumber outside of the normal lumberyard routine. Our first article in the series examines a major concern when procuring wood from alternative sources: moisture content. When you leave the services of a lumberyard behind, how can you be sure your wood is well seasoned? I only know of one way, and we discuss it on page 64. So, check out the moisture meter article, and let me know what you think!

— Rob Johnstone



One reader loved our kitchen island; a second suggested improvements and felt that it was not up to our normal standards.

Island Opinions

My compliments to you on the Kitchen Island design [October 2012]. I'm an experienced woodworker at ease with mortise-and-tenon joints, but I like to use the Kreg® system on some projects. Do you see a problem with Kreg on your project? And, I like to use metal table hold-down fasteners when attaching tabletops. Do you see any problem with that method?

Again, my compliments on the great design. I had no problems. As you can see in the photos above, I installed two handles on the drawer. I cut my own logs and a local farmer with a Wood-Mizer helped me mill the cherry stock, which I air dried for several years. I am fortunate to have 100s of board feet.

My granddaughter should enjoy her Christmas present.

Raymond D. Elish
Brecksville, Ohio



Subscriber Raymond Elish made sure that his granddaughter had a great gift under the tree this year!



The author must have considered that the challenge in designing the “Ultimate Kitchen Island” project was: how much money can I spend to do this job?

Unless you “just happened to have on hand” several board feet of 8/4 hard maple and several board feet of 8/4 cherry, both of first quality material, this project quickly becomes \$1,000 for wood alone. If there is a more expensive way to do this, I don't know what it is.

I was not impressed with wooden wheels with a relatively low load rating. I also consider a kitchen floor to be a wet environment. Wooden wheels seem a very poor choice. I think the author sacrificed function for looks. I would use polyurethane wheels at least 4 inches in diameter. Some kitchen floor surfaces are ceramic tile or stone — larger casters move more easily and are more stable on these unlevel surfaces.

Bottom line: I will build this project using a Rockler butcher block top (\$200). It is only 1.75 inches thick, but my wife looked at it and thought it was quite attractive. It is plenty heavy and will need to be cut down to match the width in the project. My wife thinks that the width is actually better than the project's 20" in terms of providing an island-like workspace. I will probably use quartersawn white oak for the structural components. It is much stronger and easier to machine than cherry. The 8/4 material is also much easier to locate than cherry.

Letters continues on page 8 ...

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On the whole, the idea of building an attractive, functional mobile kitchen island was a good one, but the execution was not well-thought-out — not up to the standards I expect from the *Journal*.

Keith Moore
Indianapolis, Indiana

WJ Responds: Pocket screws would work well for connecting the aprons to the legs on this project — especially since there are lower stretchers to add even more rigidity. But I'm kind of a purist about apron/leg connections and prefer mortise-and-tenon joints throughout. Metal tabletop fasteners should work fine for attaching the top.

In regard to the second letter, the *Journal* spent \$602.70 for all of the maple and cherry lumber (from a little one-man lumberyard — no special order for any of it). The casters have soft polymer treads on them (the black stripes in the photo), so the wood makes no contact with the floor.

The project is designed to be very sturdy and take some abuse, but it's very manageable to roll around. Four hundred forty pounds worth of load weight for these four wooden casters is far more strength than they'll ever need for this project.

— Chris Marshall



A.J. Hamler's Civil War period piece continues to garnish rave reviews. His book on the topic has 16 more projects!

More Period Pieces?

I am a Civil War reenactor who found herself jumping for joy (figuratively speaking) when I read the letter section and saw the chair ["Folding Chair Fan Club," *December 2012*]. Your editorial was fun, too. I have to remember to tell my boss that "I could have been more right about that" the next time I'm less right at work.

I am asking you to consider some future projects along the same lines. It is sometimes very difficult to find period-correct furniture plans for our camps, which is why I was excited to see that chair. One project I hope you would seriously consider is a folding table. I have seen a genuine folding table from the period once, and the undersides were all wood made to spring somehow. The legs folded in

Letters continues on page 10 ...

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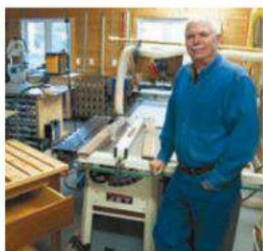
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Eastern Shore Chest

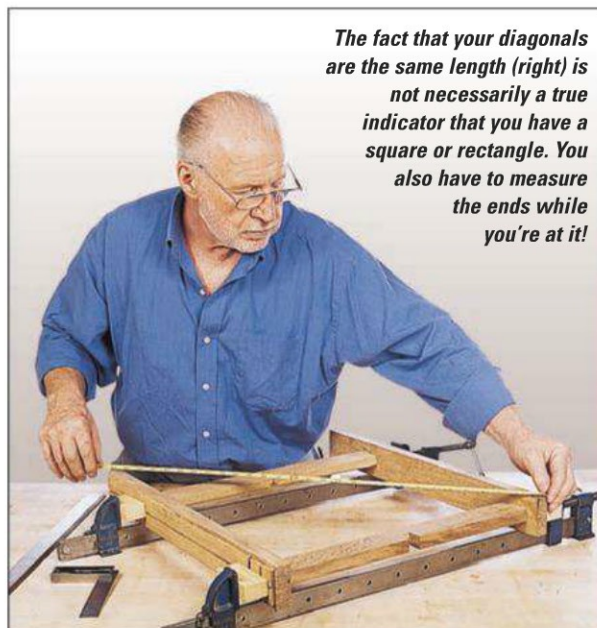
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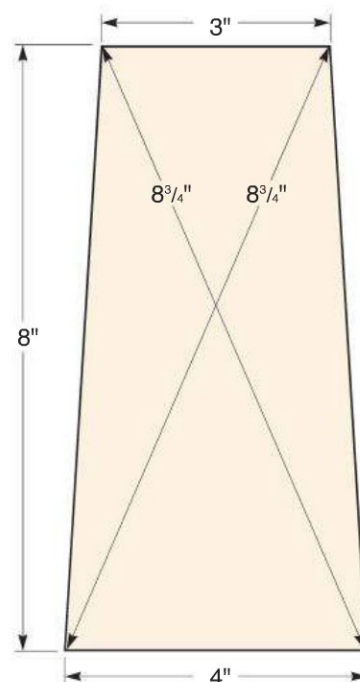


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The fact that your diagonals are the same length (right) is not necessarily a true indicator that you have a square or rectangle. You also have to measure the ends while you're at it!



and the table folded in two. I could not take pictures and don't remember if there were metal rivets. The table was rectangular.

Armless chairs and folding rockers would also be great. These would be for the women and their hoops. Any kind of camp kitchen, washstand, standing and portable writing desk, maybe even a folding cot, perhaps? I feel these would be popular with your readers and with the reenacting community.

I love the shop tips and hints in your publication and my husband admits that I read the magazine in more depth than he does! I look forward to reading much more in the future.

Jeannette M. Hilberg
Kenosha, Wisconsin

I loved the Civil War Officer's Chair in the August 2012 issue of the *Woodworker's Journal*. I used oak lumber I had cut on my farm to build two chairs. They turned out beautiful, so my wife and I think. We are going to have a drawing at our Christmas time, when all our family (30) will be at our home, for the chairs. Sounds like fun, right? Thanks so much for the plan

to build the chair. I am retired now so this is my hobby, to work in my woodshop.

Davey Walker
Crane, Missouri

WJ Responds: We continue to be amazed at the level of interest in A.J. Hamler's project. His book *Civil War Woodworking* presents 17 projects from the period and is available through bookstores. In addition, you can find a full-size pattern of the Civil War Chair in the "More on the Web" section for August 2012 on woodworkersjournal.com.

Squaring Up Mistake!

I read the email I received from *Woodworker's Journal* which addressed the subject "Tips for Clamping Squarely."

I spent almost 30 years as a customer service engineer with a machine tool manufacturer in Cincinnati, Ohio. The article makes the classic mistake of checking for squareness of a rectangle to verify the corners are 90 degrees. The problem comes about where the diagonals match exactly but the supposed rectangle is, in fact, not a rectangle. If, for example, two adjacent

corners are 89 degrees and the other adjacent corners are 91 degrees, you have what is called an isosceles trapezoid where the sides that aren't parallel are equal in length and both angles coming from a parallel side are equal. Therefore, to make sure you have a true rectangle, you must also check that the length of opposite sides are equal.

Richard Titus
Sanford, North Carolina



Those Tees Might Splinter

The "Golf Tee Inlet Plugs" trick in the December 2012 issue [*Tricks of the Trade*] concerns me that the golf tee may break or leave splinters or shavings inside the gun. I have used automobile tire caps: they fit great, leave no particles and could be tethered.

David Raynesford
Cathedral City, California

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Tricks of the Trade

Stick-on Solutions Improve Workflow



Weatherstripping Beats Space Balls

Adhesive-backed foam weatherstripping is a good substitute for those little “space ball” rubber balls used to float panels in cabinet doors. It’s available at any hardware store or home center in various thicknesses and widths and comes in 10 foot rolls. Here are the advantages over using space balls: first, weatherstripping spacers aren’t limited to a 1/4" groove — you

can buy it wider than your panel grooves and trim it to fit, but space balls will fall out of grooves that are much wider than 1/4".

Second, weatherstripping is more affordable, and the adhesive backing holds it in place while gluing and clamping the door together. And finally, unlike space balls that will roll off your workbench and bounce into every corner of the shop if you spill the bag, foam doesn’t roll. I find that the 5/16"-thick, 3/4"-wide size works best. Trim it, stick it in place and keep working.

John Cusimano
Lansdale, Pennsylvania

No-slip Straightedges

I improved the convenience of my metal rules and straightedges by affixing strips of non-slip foam kitchen shelf liner to their back sides. I used glue to attach the foam, but double-sided tape works well, too. Now, the liner holds my straightedge or rule firmly in place when I’m taking measurements or drawing layout lines, and it doesn’t scratch the contact surface on which I’m working. It’s a simple, helpful fix.

Bill Wells
Olympia, Washington



Foam weatherstripping



Rubber Band Skimmer

To keep excess stain or finish off the rims of my quart-size cans, I stretch a thick rubber band around the can from top to bottom

and across the opening. That way, with each dip of the brush I can skim the excess liquid back into the can without ever touching the bristles to the rim. I keep a couple of spare rubber bands on my finish cans and put a fresh one on each time. This way, the rims stay clean so the lids are easy to install again.

Charles Mak
Calgary, Alberta

From Bullets to Bit Storage

Plastic gun cartridge divider trays make excellent router bit holders. I use them both to store my bits and to keep similar bit styles or sets together. I find .45 caliber holders perfect for storing 1/2"-shank bits; .38 caliber carriers are just right for storing 3/8" shanks, and either .17 or .22 caliber sizes work well for holding 1/4" bits. If you’re not a shooter like I am, inquire with a local gun club, gun supplies store or at a shooting range. Most folks throw them away so you might get them free of charge.

Frank C. Manley
Broadview Heights, Ohio



.45 caliber cartridge tray makes a great 1/2" shank bit holder.

PICK OF THE TRICKS



Small Fastener Organizers

I am constantly looking for ways to recycle plastic containers into something useful for my shop. Here's a handy one: I turn those clear plastic breath mint containers into small holders for storing tiny screws, nuts or bolts. I can see at a glance what the contents are and can shake out one or two at a time for use. It takes very little drawer space to store lots of different size fasteners neatly and conveniently in these little containers.

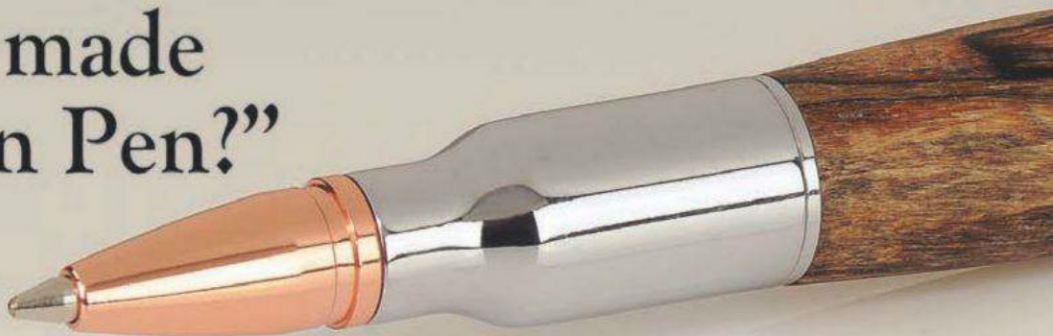
Terry Parris
Morgan, Minnesota



In addition to our standard payment (below), Terry Parris of Morgan, Minnesota, will also receive a Lamello Vario Box 440 Piece Set of Biscuits and Joining Elements from Colonial Saw (www.csaw.com) for being selected as the "Pick of the Tricks" winner. We pay from \$100 to \$200 for all tricks used. To join in the fun, send us your original, unpublished trick. Please include a photo or drawing if necessary. Submit your Tricks to Woodworker's Journal, Dept. T/T, P.O. Box 261, Medina, MN 55340. Or send us an email: tricks@woodworkersjournal.com

Safety First Learning how to operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary guards have been removed from equipment shown in our magazine. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturers' instructions and safety precautions.

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Questions & Answers

Hammering Away at an Answer

THIS ISSUE'S EXPERTS

Ian Kirby developed the complete woodworking methodology featured in *The Way To Woodwork* DVD.

Jim Stevens is a product manager for woodworking power tools at Bosch Tools.

Sandor Nagyszalanczy is a writer/photographer of several woodworking books and a frequent contributor to *Woodworker's Journal*.

Contact us At

"Q&A," *Woodworker's Journal*,
4365 Willow Drive,
Medina, MN 55340,
by faxing to (763) 478-8396 or
QandA@woodworkersjournal.com
Include your home address, phone
number and email address
(if you have one).

Q What is the purpose of using a cone-shaped mallet for carving as shown in the photo (upper right picture) on page 20 of your December 2012 issue, as opposed to a regular rawhide or wood mallet? This has always bugged me, and hopefully you'll supply a good, logical answer.

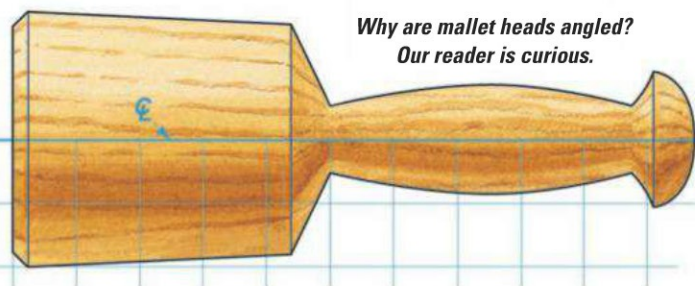
Bernie Petrasek
Kingston, Pennsylvania

A You mention three mallets in your letter: a "cone-shaped mallet," known as a carver's mallet; a "rawhide" mallet and a "wood" mallet. This last one I'm going to assume you have in mind a "joiner's mallet."

The family of hammers and mallets has more variations than any other family of hand tools. Every craft or trade that has a need to hit something, whether it is material or the end of something, has a hammer or a mallet designed specifically to do the job. The woodcarver's mallet is a descendant of the stone carver's mallet — since stone carvers predate wood carvers. Nevertheless, the two crafts have a close affinity in that they are going to hit the head of a cutting tool from



photo by Ted Clements



different angles and with different degrees of impact. Different angles because the cutting tool is constantly moved in different directions to accomplish the work. As well, the body is moved into different positions for the same reason. The conic shape of the head allows for the delivery of a meaningful blow from a variety of directions. The weight of the head — usually a dense wood such as lignum vitae or ebony — allows for a lot of energy delivered from a short swing.

The joiner's mallet is primarily used in the chopping of mortises. In this case, you are standing still in a position which allows you to deliver a mighty blow to the head of the mortise chisel. The angle on the face of the mallet serves to make the blow a direct vertical

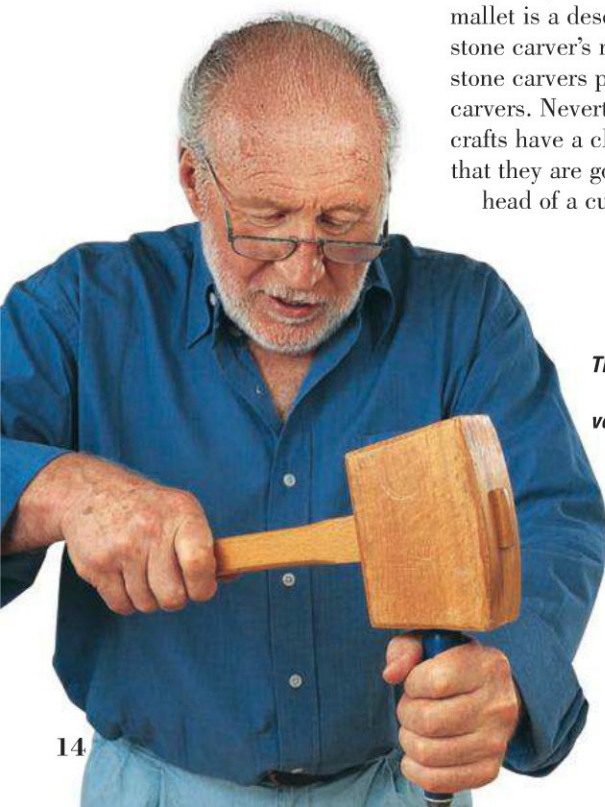
impact, driving the mortise chisel vertically. Doing the same job with a carver's mallet risks a glancing and very damaging blow from the mallet to your wrist area.

Joiner's mallets are made from European beech or hard maple, designed with an angled striking face so that the blow is delivered to end grain, where the wood will best resist deformation. Both woods are inexpensive, dense and diffuse porous, which makes them more resistant to splitting. The shaft (or "handle") is wedge-shaped so the head will not come off no matter how determinedly the tool is used.

The rawhide mallet is used by a variety of crafts. It was an early version of the hard

Continues on page 16 ...

The mallet's angled head delivers a vertical impact that accommodates the articulation of the shoulder, arm, elbow, wrist and hand.





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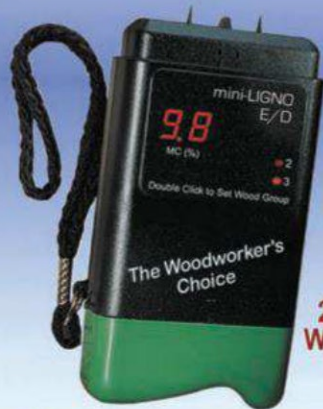
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Questions & Answers continued



Tilt Base (Trimming hard to reach areas)

Our expert from Bosch explains the use of the offset and tilt bases that are provided with some of the Colt Palm Grip routers. These bases have been bedeviling one of our readers for several years!



Offset Base (Trimming)



Offset Base (Scribing)



Winner!

For simply sending in his question on dowel sizing, Dick Clevenger of Letts, Iowa, wins an Osborne Miter Gage by Excalibur (from General International).

Each issue we toss new questions into a hat and draw a winner.

rubber mallet, and its virtue is that it will do little damage to the object being struck. You may use one for your woodworking, but it's not a traditional furniture maker's or carpenter's tool.

— Ian Kirby

Q My question may seem ridiculous to you, but I bought unit PR20EVSNK from Bosch three years ago, and I'm confused. The unit is practical and comes with a case and several accessories. But there are two of these accessories that are useless for me since I do not understand what they are used for — the offset base and the tilt base. Can you help?

Simon Lamothe
St. Celestin, Quebec

A The offset and tilt bases are used primarily for trimming laminates on kitchen and bathroom countertops.

The main purpose of the tilt base is to trim the far end of a piece of laminate on a countertop near the “backsplash,”

which is the vertical part of the countertop that butts up against the wall. This area cannot be reached using the standard fixed base, because the edge of the fixed base will reach the backsplash before the router bit can reach the section of laminate closest to the backsplash. When the router is equipped with its tilt base and a long bearing bit, it can reach and trim the complete length of the laminate alongside most such concave corners.

The offset base is typically used in retrofitting laminate on already-installed countertops. This application involves trimming laminate placed on the top of the backsplash so that the laminate doesn't project out over the front of the backsplash. In such retrofit situations, the wall prevents the fixed base from being positioned such that the bit can reach the front edge of the backsplash. The offset base, however, allows the bit to reach the front of the backsplash.

The offset base can also be used to properly fit new countertops against an existing uneven wall. The countertop is placed close to the wall, and the tip of the router's off-

set base is moved along the wall such that the backside of the offset is perfectly scribed to fit against the uneven wall.

Above are photos of all three of these applications.

— Jim Stevens

Q I've been making toys, games, furniture, etc. for many years. While making all the parts myself, including wheels, axles, hubs, etc., I've been plagued by dowels that aren't true sizes. I've tried the dedicated dowel makers, and the ones I've tried are no better generally than home center dowels. The diameter varies, sometimes in the same dowel. It's frustrating trying to fit a too-big dowel into a precisely sized hole — sometimes sloppy, sometimes even a “driving fit” doesn't work. Do you have any suggestions, suppliers, etc. to help?

Dick Clevenger
Letts, Iowa

A One practical way to deal with off-diameter dowels is to drive them through a dowel sizing plate — a sturdy steel plate that has a series of very slightly tapered holes that match common dowel

Continues on page 18 ...

Dowels that are not precisely sized are a complaint of one of our readers. Are there solutions to this problem?

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A Fishy Tale

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What's This?

Miguel Angel Hernandez of Veracruz, Mexico, found this tool at a flea market. After two hours of cleaning it with white vinegar, he found markings — and that it's 6" long and 1 1/2" wide. Do you know more about it? Send your answer to stumpers@woodworkersjournal.com or write to "Stumpers," Woodworker's Journal, 4365 Willow Drive, Medina, MN 55340 for a chance to win a prize!



Although **Jared McLaren** of Ashland, Oregon, had purchased the mystery tool shown in our December 2012 issue to practice sharpening, he still wanted to know what it was. **Merlin Ryan** of London, Ohio, suggested it could be identified as "a pruning knife, for small green branches, in tight places." **Warren Allen** of Cedar Hill, Texas, thought the item was "used to groom dogs and other animals with long hair." And **Ken Wagner** of St. Paul, Minnesota, thought it was "some sort of opener, perhaps a very early can opener."

Ricky M. Schlatter of Stacy, Minnesota, however, chastised us with the comment, "Being from Minnesota, you have to know what this is." **Mike Walrath** of Auburn Hills, Michigan, added that he has "spent lots of time using one of these over the years and [has] one in every tackle box."

It is, according to **Tim Bradberry** of Boyd, Texas, "a fish knife/scaler with a gut blade made in Sweden. I not only love woodworking, I [also] collect old fishing knives and have a couple of these in my collection."



Randy Smith of Burke, Virginia, explained, "The serrated edges are used to scrape scales off, and the curved blade is sharp on the inside edge only. It's used to cut open the fish's body cavity to remove the insides."

And **Dennis Nielsen** of Altoona, Wisconsin, put everything together for us: "The mystery tool is something I used as a kid at my parents' cabin in Minnesota. It's a three-in-one fish cleaning tool probably made in Sweden in the 1950s. The serrated edge is used to scale small fish like sunfish and crappies. The curved knife edge is used to open the gut cavity, starting at the anus of the fish and slicing forward. The spoon end of the tool is used to scrape the gut cavity. It worked great and was fast."

"After cleaning the fish, they were washed and ready for the frying pan. Yum! I so remember the crispy skin of sunfish fried in butter that my mother served up."

"Mystery solved!"

—Joanna Werch Takes



Winner! Randy Cooper of Bradenton, Florida, wins a **Kreg Jig® Master System**. We toss all the Stumpers letters into a hat to select a winner.

Questions & Answers continued

diameters (1/4", 3/8", etc.). You can purchase one from Lie-Nielsen that handles dowels from 5/8" dia. down to 1/8" dia. After clamping or screwing this plate to a benchtop, you drive a slightly oversized dowel through the appropriate hole and *voila*, it comes out perfectly sized. You can also use the plate to make your own dowels by driving a stick shaved roughly octagonal and slightly oversize through the plate. You can only make or resize dowels as long as can be hammered through, which limits you to smaller diameter dowels only a few inches long. If you need long dowels of precise diameter, you'll need to invest in a really good dowel making set. To my knowledge, Lee Valley Tools makes the best one, but even a basic kit will set you back almost \$250.



Sometimes the standard set of drill diameters are insufficient.

Another approach is to size your hole to fit the off-sized dowel. A regular set of twist drills with bits in increments of 1/64th of an inch may not do the trick. If not, try using a bit from an A-Z lettered bit set available from Enco (use-enco.com). For example, use a #C (.242" dia.) or a #D (.246" dia.) bit to accommodate a slightly undersized 1/4" dowel.

—Sandor Nagyszalanczy

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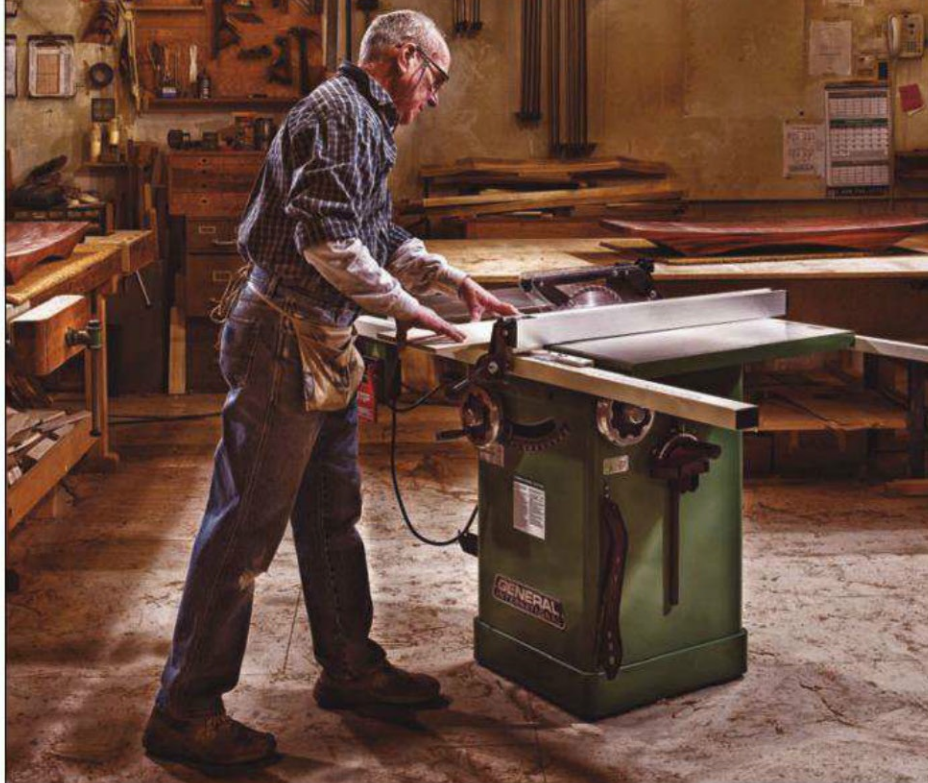
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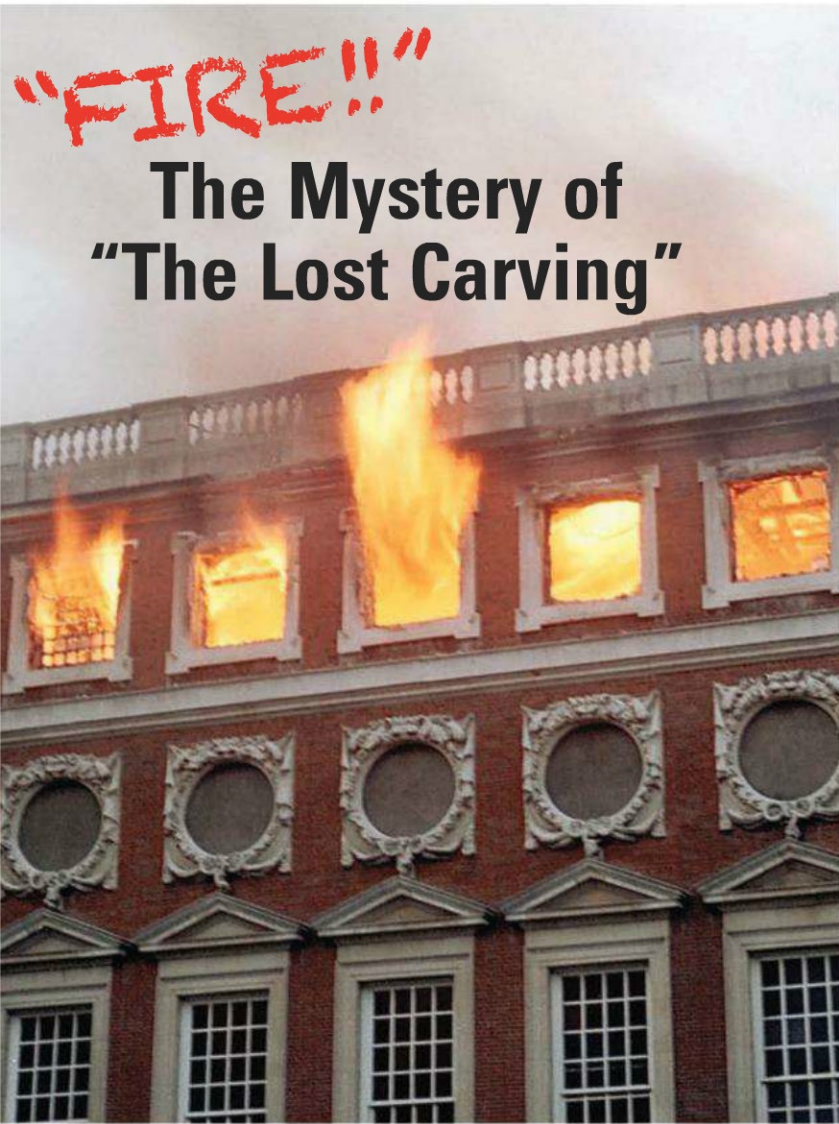
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Shop Talk

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A fire at Hampton Court Palace near London in 1986 destroyed a Grinling Gibbons carving from the 17th century, shown above in a photograph taken in 1939.

Grinling Gibbons (1648-1721) was born in the Netherlands but worked in England, where he was a renowned woodcarver in his day. He carved pieces for several members of the royal family, and for St. Paul's Cathedral in London — particularly the choir stalls.

David Esterly is a woodcarver, but a few years ago, he said, “I found myself in the middle of a mystery.” His new book, *The Lost Carving*, is in part a tale of his true-life detective work in recreating a piece from a famed historical woodworker that everyone had thought was destroyed.

David was already interested in 17th century British carver Grinling Gibbons, who frequently worked with Christopher Wren to provide decorative elements for many of the famed architect's work, when a 1986 fire at Hampton Court Palace near London severely damaged one of Gibbons's carvings. Due to that interest, plus the fact that

“it's a small field of people who carve limewood high relief foliage for a living — I think you're talking to the field,” David was hired by the British government to make a reproduction.

“What made this project interesting was that it was thought that Gibbons's technique was lost in the mists of time,” David said. “His work was terrifyingly delicate, and we didn't really understand how it was put together. I found myself in the middle of an art mystery.”

The first clue he had to go on, as he set up shop in a courtier's room at the palace (“the grandest workshop I've ever used, with beautiful 17th century panels,” David said),

was a 1939 glass plate photograph of the carving, taken when “some wise civil servant sent people up on ladders to take quick photos in case things were destroyed as the German bombers were circling London.”

The carving survived the war, only to suffer damage in the 1986 fire, thought to have been caused by a bedside candle in the room of Lady Gale, the widow of a decorated World War II military officer who had been given permission to live in the “grace and favor” apartments above the main royal apartments. Lady Gale died in the fire. Christopher Wren's 17th century soundproofing — a layer of small seashells between the



floor joists — prevented the fire from spreading to the floor below for long enough that castle guards had time to remove the art from the royal apartments, “but Gibbons’s carvings were nailed to the wall,” David said.

With the damage from the fire, and the high-pressure fire hose, “I was told at first that nothing survived, but it turned out that there was at least one key lump of charred material,” David said. He had had the photo blown up to the 7-foot length of the carving but, although he knew the carving had projected 6" or 8" inches out from the wall, “the photo makes it look flat as a pancake. It was hard to read what the projecting parts were” — plus, the sections that were closer to the camera looked larger.

Then, someone found a charred lump that had originally been carved crocuses from the center of the carving. “That was key: I could see how many layers of carving there were,” David said. Since they were forward elements of the carving, he also laid them down on the blown-up photo — and found out the size of the image was off about five percent.

Another challenge? “Gibbons was a supremely good carver. My biggest challenge was ‘Can I be as good as he was?’” David said. He described Gibbons’s style as “flamboyant.” “I used to think the apparent thinness of his leaves was an optical illusion, but it’s not. He was extremely bold in his undercutting.” Figuring out Gibbons’s carving details, and his use of layers, was key to the project — and “unless that little lump of charred material had been found, I’m not sure I would have been able to do it,” David said.

“I learned early on that to copy a leaf so that it looks like a leaf, you need to do what Gibbons did, and exaggerate the curves. All those exaggerations make a leaf look like a leaf.”

Gibbons did his carvings in limewood — the British name for linden, which David notes is a different subspecies from American basswood — and David had hoped to use wood from some old trees on the castle grounds, but the growing conditions didn’t produce the good wood he needed. “Basswood is just not quite good enough: it doesn’t



have the density and strength and crispness of the grain that European linden has,” he said.

He described limewood as a very pale, almost creamy colored wood, and noted that one of Gibbons’s innovations was to attach such pale carvings to dark oak paneling. Gibbons left the carvings bare, and received a pension of 100 British pounds a year (several thousand in today’s money) from Windsor Castle to maintain them. They

American carver David Esterly (above, left), hired to reproduce the piece, found it challenging to duplicate the skill of the historic woodcarver in his reproduction (above).



David used his own chisels and gouges on the reproduction. Gibbons's carving tool collection, he noted, was even more extensive than his own 130 pieces.

darkened after his death, and David's carving was painted "medium brown" — over his protests — to match the others. "I'm still on a campaign to lighten them, 20 years later," he said. "If you want the true effect of Gibbons, you want pale."

He suggests bleach, noting that a 1970s attempt to lighten the carvings with wax was "a bad idea" — but it did provide a clue to another Gibbons carving mystery. Despite earlier impressions that Gibbons took his work "straight from the chisel," the wax application made it clear that he used some kind of abrasive. Since sandpaper wasn't invented until the 19th century, however, "what abrasive" was the question. In the process of his work, David

discovered a pattern of three or four striations, just barely visible to the naked eye, on Gibbons's work. He eventually matched the pattern to Dutch rush, a small leafless plant that grows in sandy soil and absorbs silica that it deposits on the surface of the plant.

David's detailed journal of all of these detective experiences, written during his train commutes back to London after working on the Gibbons carving, became the basis for his book, *The Lost Carving: A Journey to the Heart of Making* (Viking, ISBN 978-0-670-02380-6), published this winter. Partly, David said, the book is a philosophical defense of carving and handwork, but "it's purposely written in small sections. If you just

want to get the story, you can skip that section and follow the carving plot: one of the most daunting carving challenges in recent times."

The experience, he said, "really changed me as a carver. You can achieve 90 percent of the effect with 50 percent of the effort, but the last 10 percent — the radical undercutting, the thinness of the stems, whatever — may require another 50 percent of effort. It's that 10 percent that makes all the difference, and it's always, always worth doing."

For further information on David Esterly, his book and the Gibbons carving, visit www.davidesterly.com or thelostcarving.blogspot.com.

— Joanna Werch Takes

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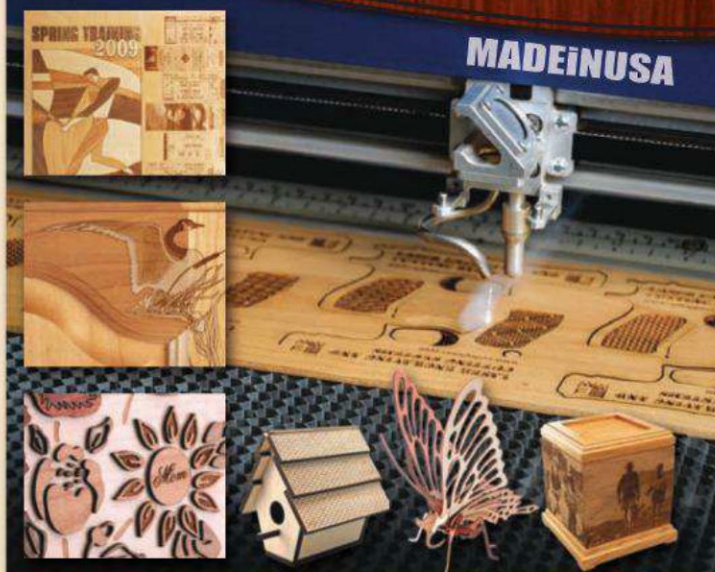


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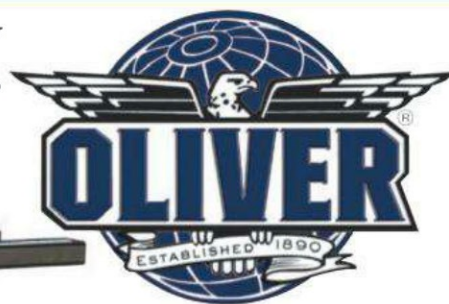
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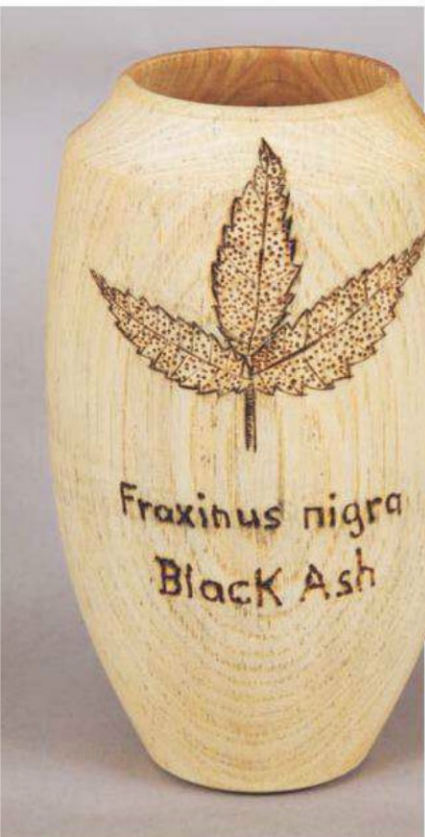
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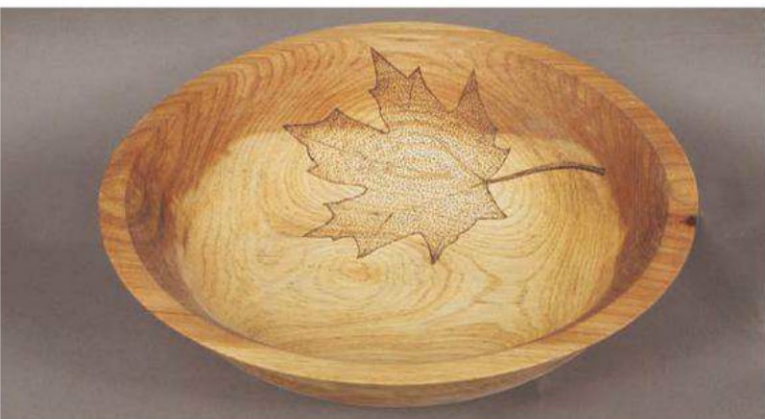
Pyrography and Turning

By Ernie Conover

Turned pieces can easily be accented by woodburning, aka pyrography — providing a wonderful means to add interest to your turning. Here's how to get started.



I used an actual maple leaf for the bowl at right. On the pot at left, I drew ash leaves (which I've been told look more like leaves from a controlled substance!).



Another maple leaf was used to enhance this maple platter (above). Note the shading and texturing in the design.

New techniques can add interest and beauty to woodturning, or really any type of woodworking. One that I find useful is pyrography (or "woodburning"). While you may think that woodburning

is simply drawing with a blowtorch, that is far from the case. It is an art form in its own right that can add shadow, texture and color that support your turning in new and intriguing ways. With that said, you don't have to possess Leonardo daVinci's powers of sketching to do great woodburning. Impressive design can be accomplished by burning various patterns and textures into surfaces, making them startling and intriguing to the viewer. Let's look at the road to becoming a pyrographer as well as a woodturner.

Woodburners can be had at prices ranging from less

than \$20 to \$300 and more. For less than \$50, you get what is essentially an inexpensive soldering iron. They are a good place to start without spending much money. For signing the work, blackening a background or stippling, an iron-type burner will do nicely.

If you get serious about woodburning, you will want to invest in one of the more expensive units. Better burners have a transformer and circuit board in a control box, which gives you more control. Compact pens are connected to the box by a set of wires, and temperature is controlled by a potentiometer.

MORE ON THE WEB

For a video of the author demonstrating decorative woodburning for turned objects, visit woodworkersjournal.com and click on the "More on the Web" tab shown above.

Getting Started

Your wood should be sanded to about 180-grit for trouble-free woodburning. A close grain wood like maple will be easier to mark on than an open grain wood like oak. Each piece and species of wood tends to require a different setting of the potentiometer depending on dryness and any finish present. Green wood burns fine, and a coat of oil finish does not seem to make much difference. The fumes can be annoying, however, so placing a fan to blow across the work is a good idea, as is good ventilation. A small computer fan works great.

If you want to draw on your piece as a basis for your burned design, it can be something simple like the feather in Walt Wagner's bowl (below) or my leaf drawings. I used an actual leaf for mine and traced around it. Lightly outline what you want to draw with a soft pencil, then burn the outline with a skew. The pencil lines can always be sanded away, but a Mars® Plastic Eraser (available at art and office stores) will usually remove them completely if you use a soft pencil and a light touch.

Combining Techniques: Turning, Rotary Carving and Pyrography

I have been turning wood for about 10 years, but I am new to pyrography and rotary carving, which I became interested in after attending a Cynthia Gibson workshop. Here, I used pyrography to blacken the background of orchid flowers that I carved onto the surface of my vase. A bird carver friend recently taught me how to burn feathers, an example of which is shown in the bowl. Pyrography and rotary carving adds novelty and personality to my pieces. Like everything else, it takes practice and patience.

Walt Wagner, Studio Coordinator
Camelot's Woodworking Studio,
King Arthur's Tools
Tallahassee, Florida



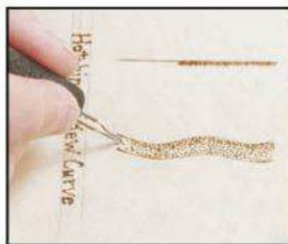
Woodturning continued



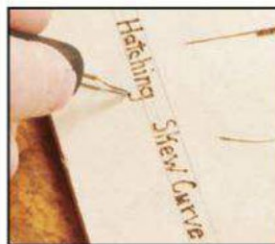
Using a skew to hatch an edge



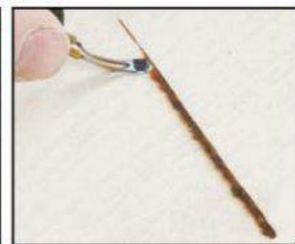
Using a skew to draw a curved line



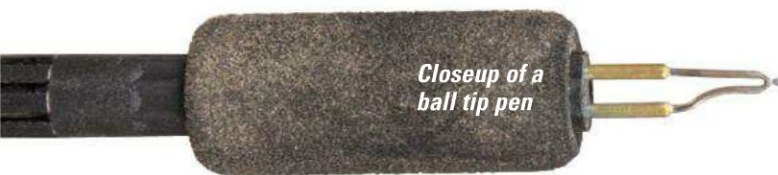
Using a ball tip to stipple



Using a ball tip to letter



Using a shading tip to shade



Closeup of a ball tip pen

Types of Pen Tips or "Nibs"

All manufacturers offer a wide selection of nibs. Some manufacturers allow you to buy a couple of pen bodies and change the nibs by inserting them into the pen. Others steer you toward entire pens for each nib style. You will quickly find that you do 90% of your work with a few pens, and it is good to have these dedicated. I did all of the drawing of the leaves shown in this article with just three pens.

1. A **Small Skew** was used for all of the outlining, but some areas were later intensified with the ball pen to give the lines more weight. This delicate tip comes to a sharp point with a straight edge extending back from it at about a 60° angle. This pen is very fussy about presentation angle.

2. A **Ball Tip Pen** is great for intensifying lines, lettering and stippling. I use a small .8mm (1/32") diameter ball tip. Its most endearing feature is its unfussiness about presentation angle. Most drawings require hundreds, or even thousands, of stippling dots, so easy is good!

3. A **Shading Pen** is for just what the name implies. This pen is very fussy about presentation angle.

Woodburning Options



I've used inexpensive plug-in units for many years to sign my work.



Better woodburning units have pens that are much more like a fountain pen, making drawing much easier.



Pens connect to the power unit with either mono phone jacks or RCA plugs.

Manufacturers offer adaptors to use other pens, or you can make up your own from Radio Shack® components.

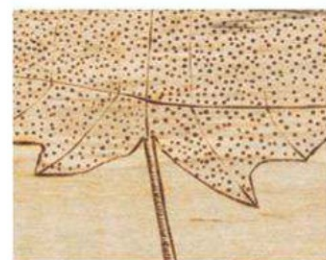
Now Fill in the Detail

As stated earlier, much can be done with shapes and texturing. Decoy carvers use all sorts of arc tips to evoke feathers, so it is easy to find these pens. A wide range of circles is also offered.

Pyrography is much like drawing with a pencil. However, when you first touch the tip of the nib down on the work it has a lot of residual heat, whether it is a simple iron-type unit or a high-tech model. Therefore, you need to touch the tip down precisely, then move fast for a short distance, slowing down as the heat drops. This keeps an even strength to your line. I use a small skew tip for lines, moving fairly slowly (except at first) to give a strong line or quickly to get a light one. I sometimes go over a skew line with a ball tip to give it even more weight. Making lines stronger at the bottom of your

drawing gives it a quality of being connected with a surface — what is called a proximity shadow in drawing. Once the drawing is outlined, you need to create shadows and texture to bring it to life. This can be done by shading, and all manufacturers offer shading tips to darken areas. I prefer to use pen and ink techniques of stippling and hash lines. I use a ball tip to randomly place dots. Stippling gives the sense of a surface and also shadow. By stippling heavier on one side and/or the bottom of the drawing, light direction and shadow are evoked. Stippling may also be applied to the background to draw attention to a drawing or carving on your work. Blackening can achieve the same result, as in Walt Wagner's Vase (see page 27).

I also use hatching to denote an edge in shadow. Hatching is short parallel lines along an edge that evoke surface,



Hatching on the left side of the stem gives a sense that light is coming from the right and the stem is round. Stippling draws the eye to the leaf and creates a "surface."

shape, depth and shadow. The skew accomplishes this nicely, but a custom tip that will burn a curved line will evoke a curved surface.

I hope you'll give woodburning a try as it is a great way to take your turning or woodworking further. One final note: try not to burn yourself!

Ernie Conover is the author of *The Lathe Book*, *Turn a Bowl with Ernie Conover* and *The Frugal Woodturner*.

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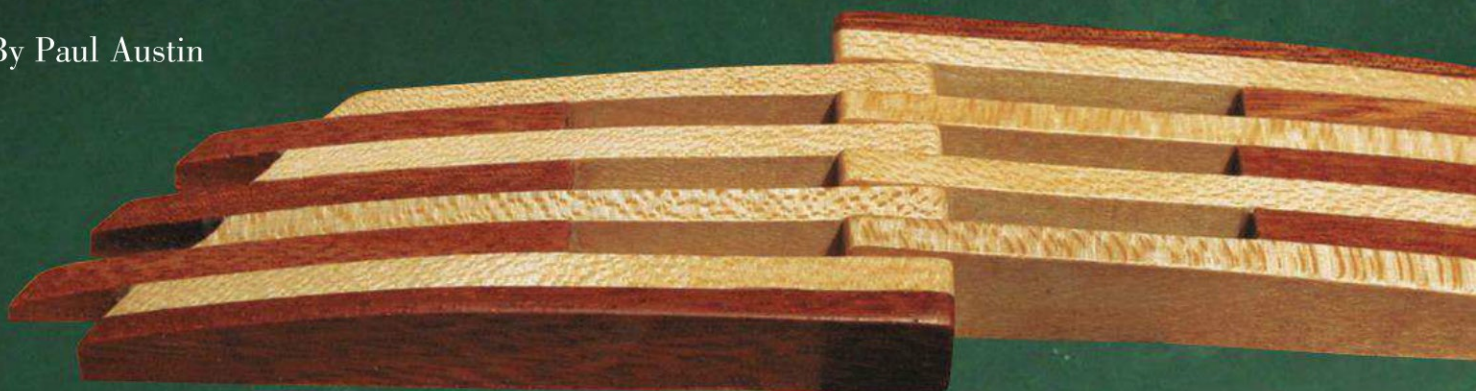
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How to Make a Classic Comb Hinge

By Paul Austin



The various boxes shown here are examples of the many different directions a comb hinge can take. Easy to assemble and apply, they add a touch of elegance and intrigue to even a simple box.

I was asked a short time ago to make an exotic wood box using some reclaimed timber and wooden hinges. I have found in the past that the usual wooden hinges can sometimes seem clumsy and oversized and can take quite a bit of time to make, so with this in mind I set out to develop an elegant and easy-to-make hinge that would also be strong enough for their purpose. The following is a step-by-step guide to my construction process.

Dimensional Flexibility

As you may have already surmised, the exact dimensions of your hinges are a matter of scale and personal taste. My preference, as you can see at right, is for larger hinges that add a certain amount of decorative flare. I like to use 1/4" stock to build up my comb hinges. The length, of course, depends on how long you want your hinges; the width, on the shape you're shooting for. Just make sure you have enough stock on hand to allow for all of your leaves (remember, the end leaves can be half the thickness of the inner leaves). You can use fewer leaves if you like, but you will need to machine them a little thicker. For my purposes here, I'm starting with a piece of yew. Most any sturdy wood will make for a good choice, but it must be knot-free, as a knot in a leaf will seriously weaken the hinge. Your first step is to cut all your leaves (both thicknesses if necessary) for each hinge. A small band saw or scroll saw is the preferred tool for this step. Choose defect-free timber, remembering to cut with the grain.

When you've completed your bandsawing, you should have made more than enough of each size so that you've got some backup if one leaf fails. The first sanding step is best completed with a simple sanding block. Just glue some 100-grit sandpaper to a piece of flat stock or clamp a piece to a flat surface and give each leaf a thorough smoothing. I prefer aluminium oxide paper for this step.

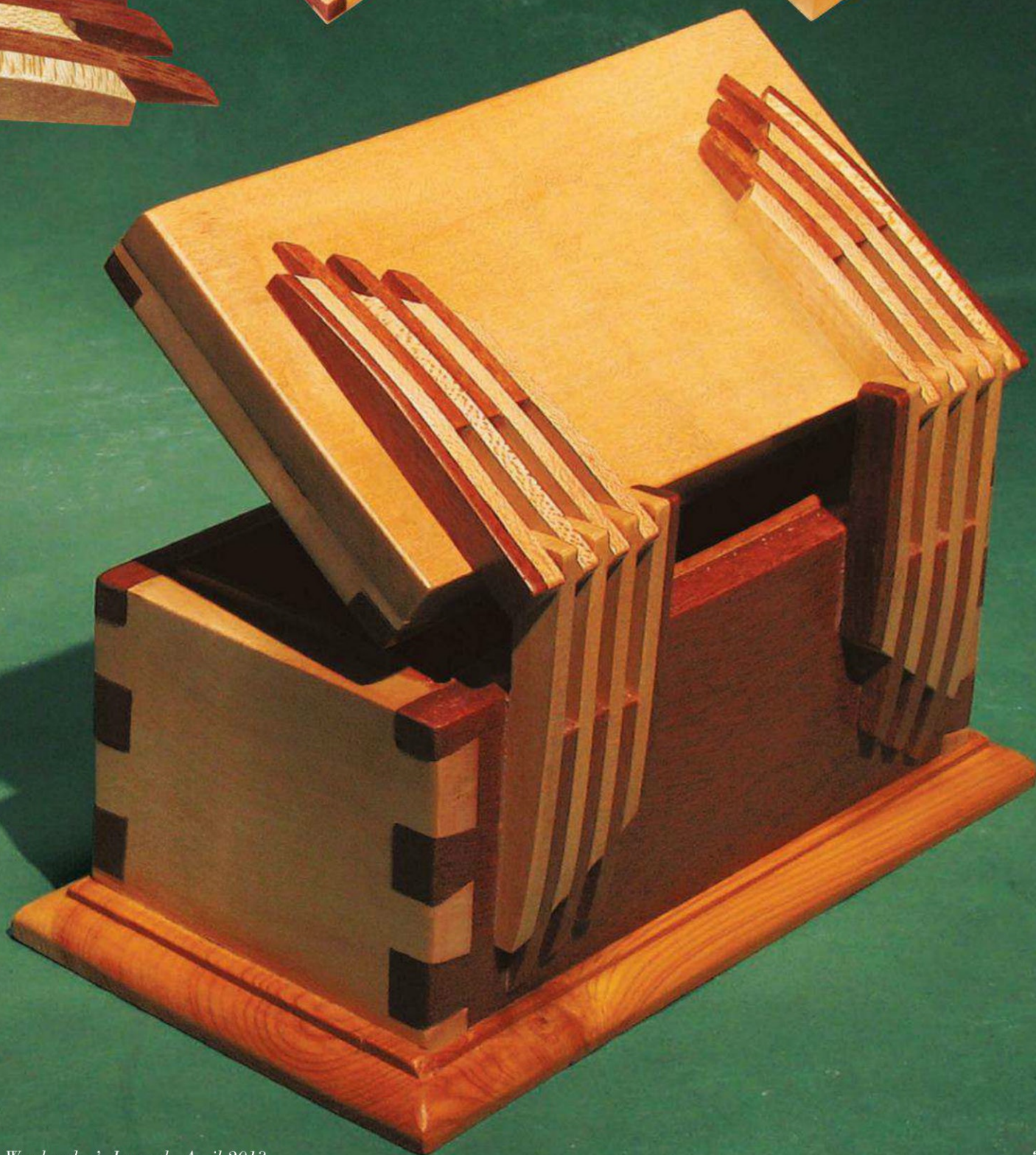
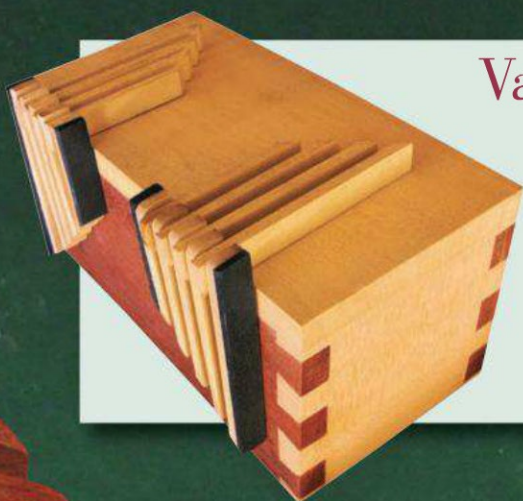
Once all your stock has had its first sanding, I find that the easiest way to drill out the leaves accurately is with a

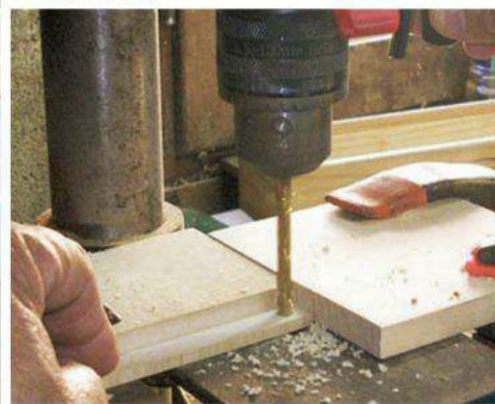


A band saw is the best tool for machining the leaves. Make sure to have plenty of stock on hand for both hinges, and to use knot-free lumber.

Variations on a Theme

Our author regularly employs lots of different approaches to his comb hinges. Just remember, he says, the fewer pieces you use, the thicker they should be.

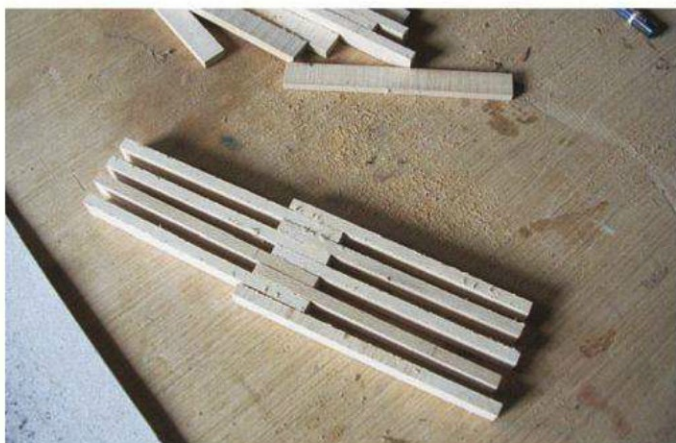




To locate the hinge holes, the author simply clamps two square pieces of stock to his drill press table and centers up a hinge leaf, equidistant from the sides and the end, as shown in the close-up photo above.



Once all his leaf holes are drilled, the author inserts his pivot. If the pivot is a wooden dowel, he suggests a slight sanding at the ends to ensure a good fit. Other material options include brass or steel rod.



Once the author has his basic hinge built (above), there are a number of directions he can follow. In the three-photo sequence at far right, he tapered the ends (top photo), added contrasting species between the leaves and covered the pivot with that same contrasting species. Tapering and beveling the shape achieves an Art Deco look.

simple, no-fuss jig. If you have a drill press, clamp two pieces of scrap wood onto the machine table, forming a square inside corner. Drill a 3/16" hole an equal distance from both the sides and end of a leaf, as shown in the inset photo above. Be sure to drill a few test pieces first to ensure accuracy before you get going on the rest of them. While it's not optimal, this step could be achieved with a hand drill if necessary.

Once all the holes are drilled, insert the leaves onto your pivot. If you are using a brass or steel rod, it's a good idea to file the point a little. If your pivot is a wooden dowel or rod, I recommend sharpening the end slightly with sandpaper or a utility knife. It's a 3/16th" rod going into a 3/16th" hole, so it's going to be a tight fit, especially if it's wood on wood. Snip off the inserted rod flush to the end leaves and sand or file off any burrs.

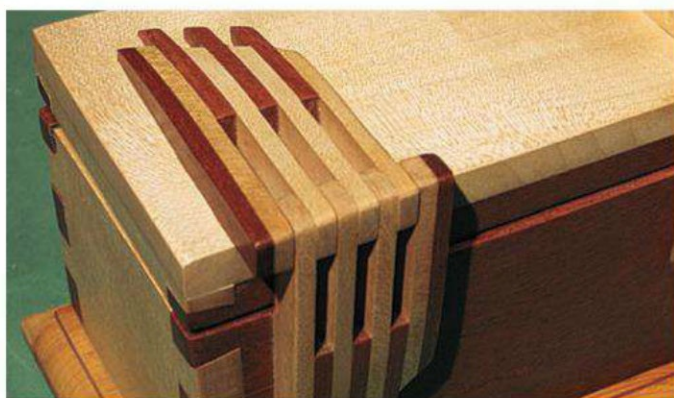
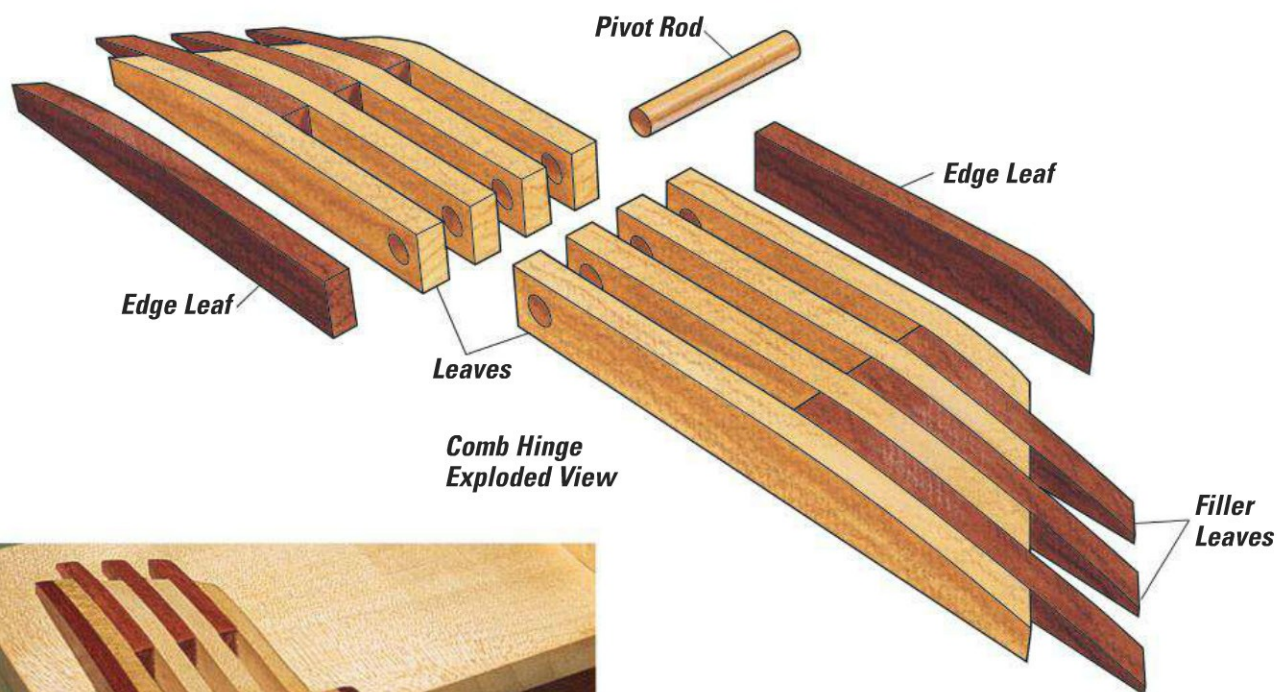
Gluing on the Edge Leaves

The idea of gluing on half-sized edge leaves of a different color wood is to hide the end of the pivot rod or dowel and, of course, to stop the pivot rod from slipping out of the hinge. This way, once the leaves are fixed to the box, they can't slip off the pivot. At the same time, the contrasting species give the hinge a nice decorative look. (Note: when I can find them, I've been known to use old ebony piano keys that I cut down to size.)

When it's time for the glue-up, I've had good success using a couple of butterfly clamps. It should be noted here that the end pieces don't have to be half-size — it just depends on the final look you're after. Once the glue is dry, give the piece a good sanding. Remember that one of the pivot ends should be rounded off a little.

Cutting the Hinge to Final Shape

With the edge leaves in place, open the hinge by folding back every other leaf. At this point, you can cut the shape you want on your scroll saw or band saw. I'm cutting these at an angle to create a bit of an Art Deco look. I'm also leaving one end longer than the others; this is so the longer end of the hinge will incorporate the depth of the box lid. It is an easy job to inlay more



This hinge (under construction at right) features two contrasting species. The ends of the leaves are tapered in two steps and then beveled.

leaves of a different species of wood into the gaps to give an even more decorative look, as shown in the photo above.

At this point, you can finish rounding the knuckle ends of the pivot. To do this, it's easiest to clamp the hinge to a square block. I used a small belt sander for this job; however, a sanding block is just as good. When you're happy that the hinges are nicely sanded and any high points are smoothed off, it's time to glue them onto the box. Close the lid box in the required position, apply a thin layer of glue onto each leaf, and position them where you want them on the lid and back. If your box is the type of construction where you've glued on the top, then cut off your lid with a band saw. Be careful not to apply glue where the back edge of the lid contacts the hinge assembly or the box will not open.

These hinges are very versatile. The leaves can be curled outwardly on the box lid just by soaking them in hot water. They can easily give an inlaid look by cutting the same number of leaves in a different color wood and then gluing them into the gaps. The size can be very small — I've made boxes that are scaled right for using 1/32" pivot rods and I've made very big boxes, using a 3/4" pivot rod (a trunk or blanket box). In fact, I have found the possibilities to be nearly endless.

If you would like to make a hinge of a similar size but with fewer leaves, you can use a 1/4" dowel hole with 1/4" dowel and 7/16" leaves. The bigger the hinge gets, the more concern dowel friction becomes. As usual, once you've completed your first box with comb hinges, the rest become easy work!

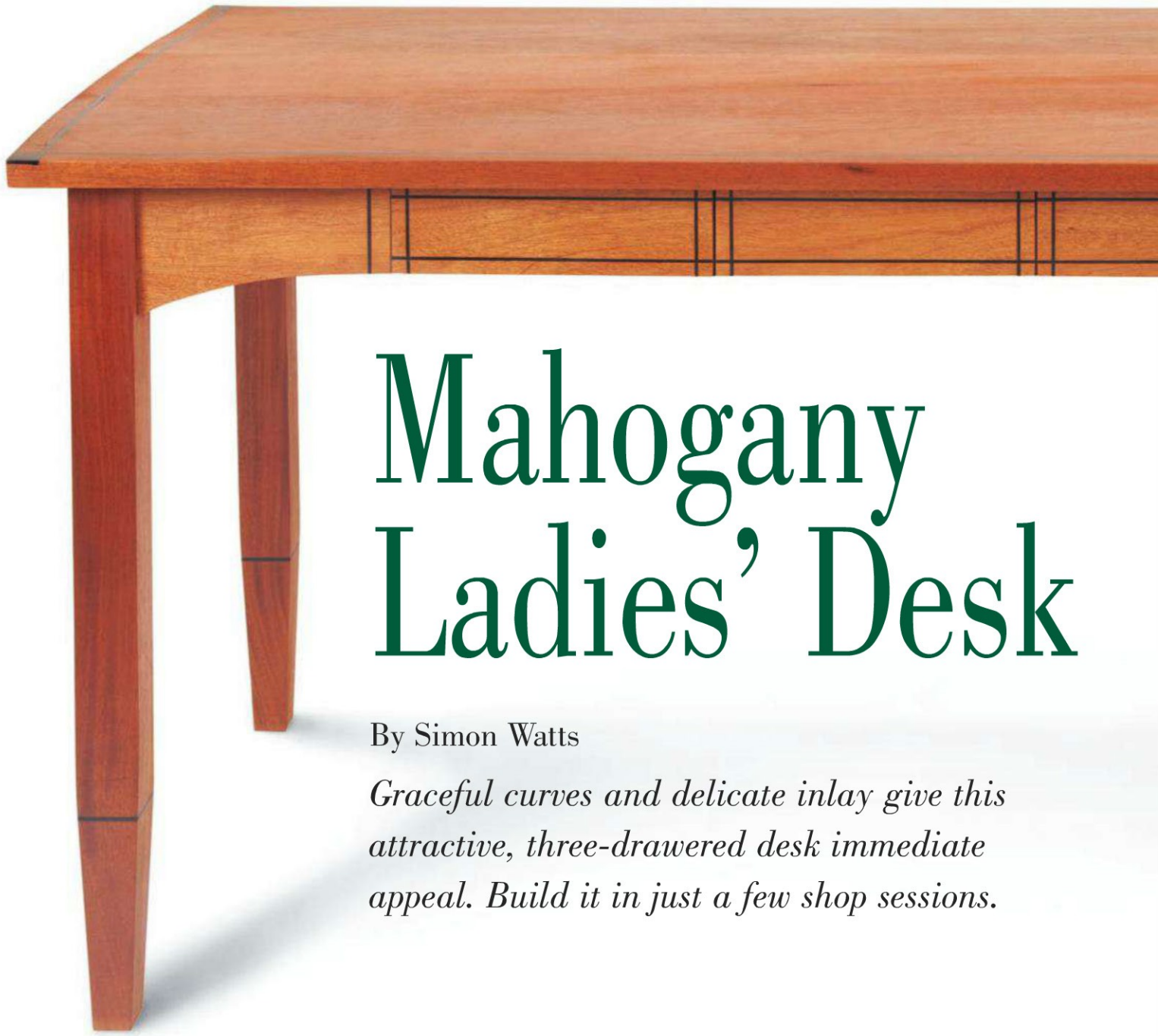


As demonstrated in the three boxes shown on the second page of this article, there are lots of options available with comb hinges. In this sequence, bevels are made, a second set of leaves are added, and edge leaves are employed to cover the pivot.



Once the glue sets, everything is sanded, the new leaves are cut to length, and their bevels and tapers (see finished photo above) are added.

Paul Austin is a British woodworker who maintains a shop in Montemboeuf, France.



Mahogany Ladies' Desk

By Simon Watts

Graceful curves and delicate inlay give this attractive, three-drawer desk immediate appeal. Build it in just a few shop sessions.

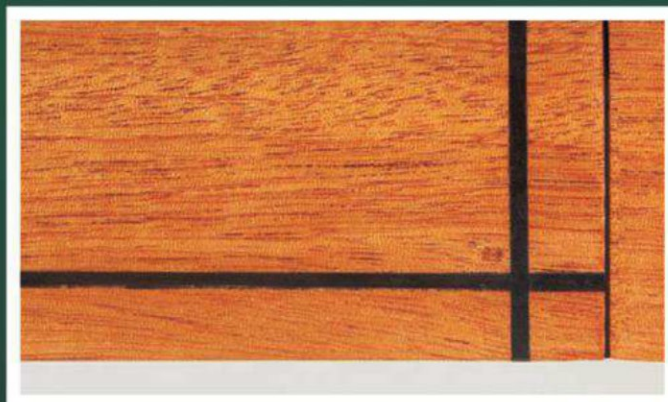
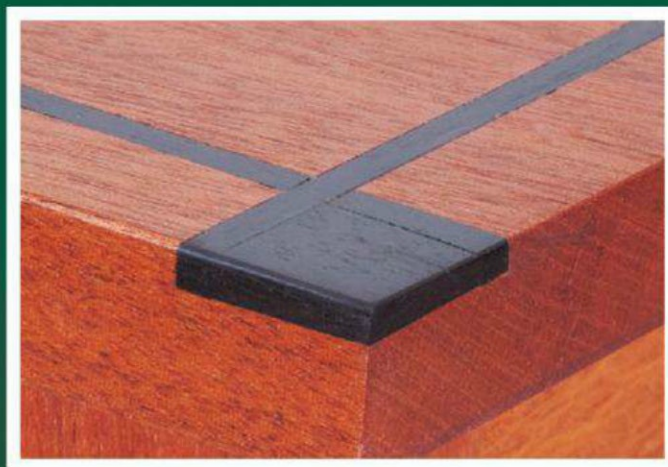
I think of this piece as a ladies' desk (it was made for a lady) perhaps because of the feminine curves — as opposed to the more usual straight lines and hard corners of most desks. I did not intend this, but it was one of those designs that just evolved on its own. Anyway, the lady was pleased, which was just as well since we share an apartment in San Francisco.

I used mahogany for the desk, with ebony inlay, but other combinations would be equally suitable — walnut with maple inlay, for example, or cherry with rosewood. Cutting slots for the inlay is tricky ... one slip of the router and you'll have to start over. But I feel adding inlay to the top and carrying that theme over onto the drawer faces and legs adds elegance to this project.

If you work carefully, guiding your router against a straightedge or a curved template, you'll have good success here.

Beginning with the Top

Start by gluing up stock for the desk top and rough-finishing it so there is a level surface for the router, then lay out the curves at the two ends. I initially set a beam compass to a radius of 52" — the same length as the desk — intending to cut it on the band saw using a pivot. However, the curve looked wrong ... too mechanical and simple-minded. So I picked a straight-grained batten and put pressure on the ends with a long bar clamp, as shown in the left photo on page 36.

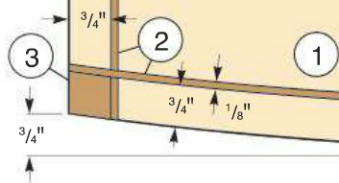


By changing the clamp pressure, I could adjust the amount of curvature very precisely. I don't know if the curve so generated has any mathematical pedigree, but I suspect it belongs to the same family as suspension bridges. Anyway, it looked right for this desk, so I marked the curve with a felt-tipped pen and then sawed it by hand with a 300mm Japanese saw. The flexible blade is ideal for cutting shallow curves such as this one.

I used the offcut as a sanding block to smooth the ends of the desk top, then traced the curve onto scrap and sawed it out as a template guide for the router. By clamping this guide to the desk top, I could rout out a groove for the inlay with confidence. If you are not comfortable making this cut with a router, I suggest

Whether you build this desk from mahogany with ebony inlay as the author did, or choose another wood combination, the inlay pattern will add elegance to the design and help to make your desk distinctive. While it may look difficult, the process is actually quite simple: rout shallow slots, fill them with bandsawn strips of your contrasting species and plane, scrape or sand it flush.

"I don't know if the curve so generated has any mathematical pedigree, but I suspect it belongs to the same family as suspension bridges. Anyway, it looked right for this desk, so I marked the curve with a felt-tipped pen and sawed it by hand with a Japanese saw."



Desk Top (Top View)



Springing a batten in this fashion with a clamp (left) gives you a more attractive, interesting shape than the arc of a circle. The author cut the desk top's end curves with a fine-tooth Japanese saw (above). Its narrow, flexible blade can accommodate modest curves like these.

you practice on scrap wood until you are. Use a straight 3/16" carbide bit and be sure to go against the direction of the bit rotation. Otherwise, the bit can take charge and run away with you.

Cut the groove in the curved ends first and then, using a straightedge as a guide, cut slots along the long sides. Doing it this way minimizes tearout where the two grooves intersect. When done, use the router again with the same depth setting to cut the shallow notches at each corner for squares of inlay that join the strips where they meet.

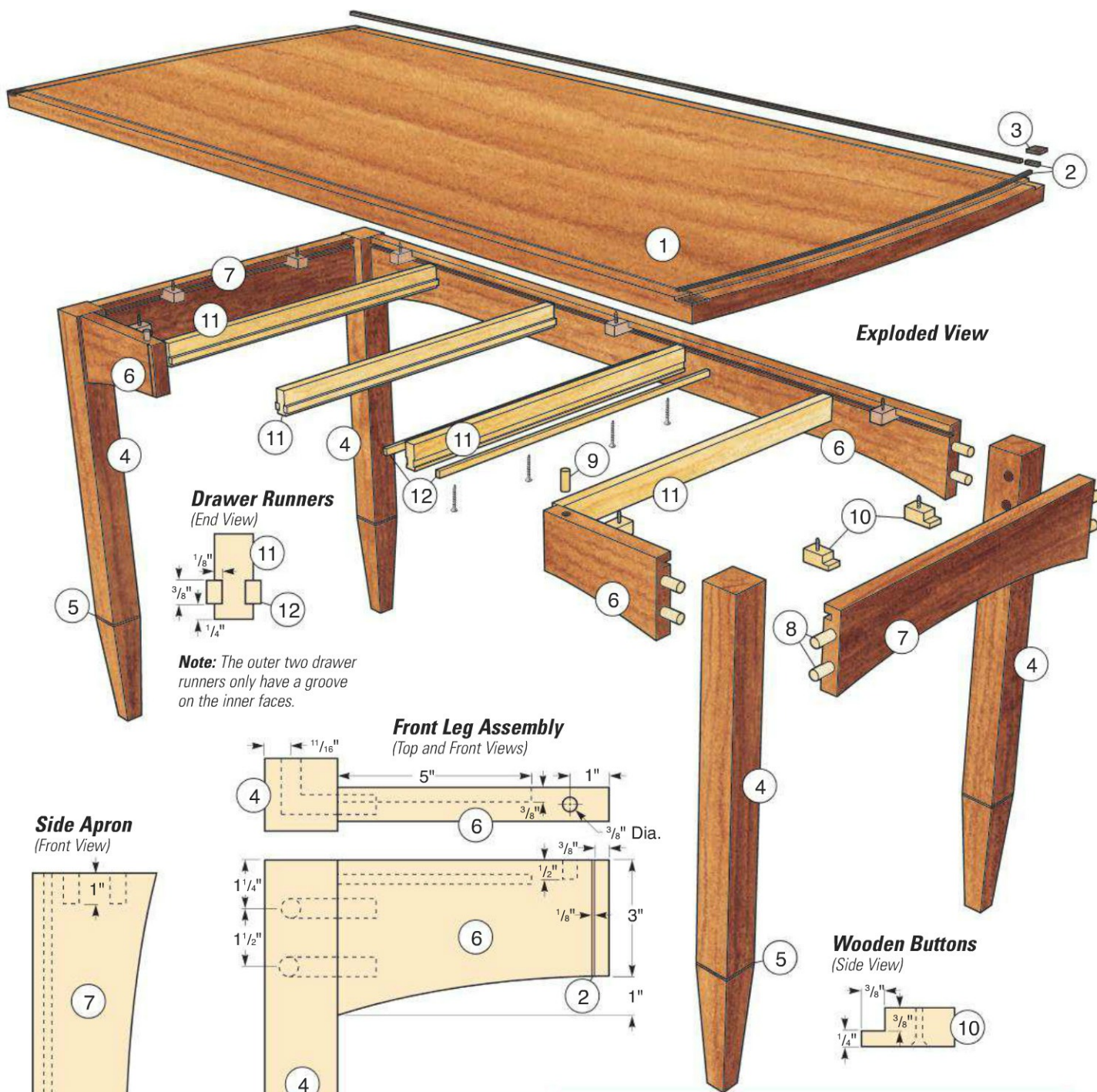
When cutting a precious wood such as ebony into inlay strips, I minimize waste by clamping a fence to the band saw instead of using the table saw. This works best with a 3/8"- or 1/2"-wide blade, because it's less likely to wander in the cut.

After cutting sufficient strips of inlay — you can butt them end to end if necessary — glue them into their slots. Start at the curved ends using a piece of hardwood scrap with wax paper in between so you can apply even pressure with clamps. Glue the long sides next. Now cut the small squares of ebony for each corner and glue them into place. Clean the top up with a block plane and scraper, sand it up to 120-grit, and set it aside to work on the base.

Assembling the Legs and Aprons

The legs are square in section and are tapered below the ebony bands. Cut them to size, and taper their ends (see bottom left photo on page 38). Slots for the leg inlays are best cut against a miter gauge on the table saw using the rip fence as a stop. It's a simple procedure. With the legs done, make up the front, back and side aprons. Use the flexible batten to form the bottom curves on these parts before shaping them at the band saw. Mark the location of the three drawer faces on one of the long aprons, but don't cut them out yet.

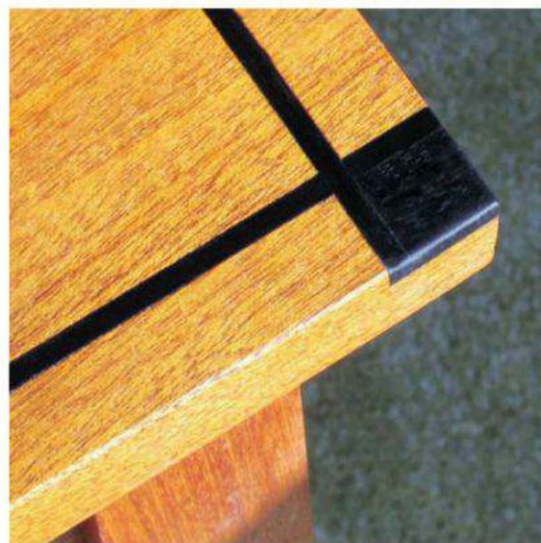
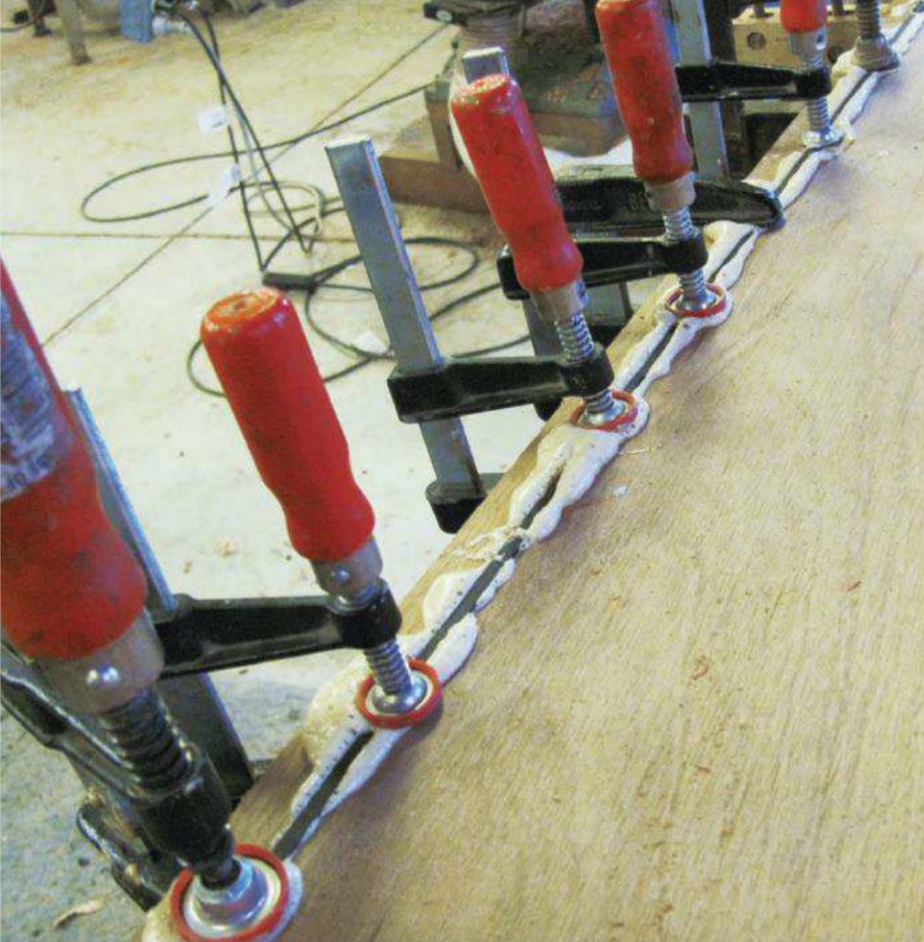
Before final assembly, mill a shallow slot for the wooden buttons on the inside of the aprons at your table saw or router table. These



MATERIAL LIST (DESK)

	T x W x L
1 Top (1)	7/8" x 24" x 52"
2 Top Inlay (1)	1/8" x 1/8" x 104"
3 Top Corner Inlay Blocks (4)	1/8" x 3/4" x 7/8"
4 Legs (4)	1 7/8" x 1 7/8" x 26 1/2"
5 Leg Inlay (1)	1/8" x 1/8" x 34"
6 Front and Back Aprons (2)*	7/8" x 4" x 44 3/4"
7 Side Aprons (2)	7/8" x 4" x 18 1/2"
8 Leg Dowels (16)	1/2" Dia. x 2"
9 Apron Dowels (2)	3/8" Dia. x 1"
10 Wooden Buttons (9)	5/8" x 3/4" x 1 1/2"
11 Drawer Runners (4)	5/8" x 1 3/8" x 19"
12 Drawer Supports (6)	1/4" x 3/8" x 19"

* The drawer faces are cut from the front apron.



After carefully routing shallow grooves in the desk top, the author used polyurethane glue (note the foam) and many clamps to install the ebony inlay (top left). Squares of ebony (top right) were added next to accent the corners. Planing, scraping and sanding leveled the strips and completed the attractive design (right).

will connect the top to the base and allow for seasonal wood movement. Be careful to stop the slot cuts short of the drawer fronts on the front apron (see *Drawings*). With that work behind you, join the legs and four aprons together with pairs of 1/2" dowel pegs and glue. As you clamp the assembly up, be sure that the legs are parallel to each other (or even toe out slightly) by adjusting the placement and pressure of the clamps.

After the glue dries, mark out and cut the three drawer fronts free with a thin, fine-tooth saw. Label them clearly so you can reassemble them in the same sequence. This gives a consistency of grain and color — important in a delicate piece of furniture such as this desk. Make four crisscross cuts on each drawer

face with a thin-kerf blade at the table saw to fit the 1/16"-wide inlay strips. Then cut slots across the ends of the "stub" apron pieces of the front apron for inlay here, too. Glue the inlay strips in place and then plane or sand them flush. Notice in the *Drawings* that I added a single dowel near the cut ends of the front stub apron in order to lock them in place underneath the desk top. They also will receive a wooden button and screw.

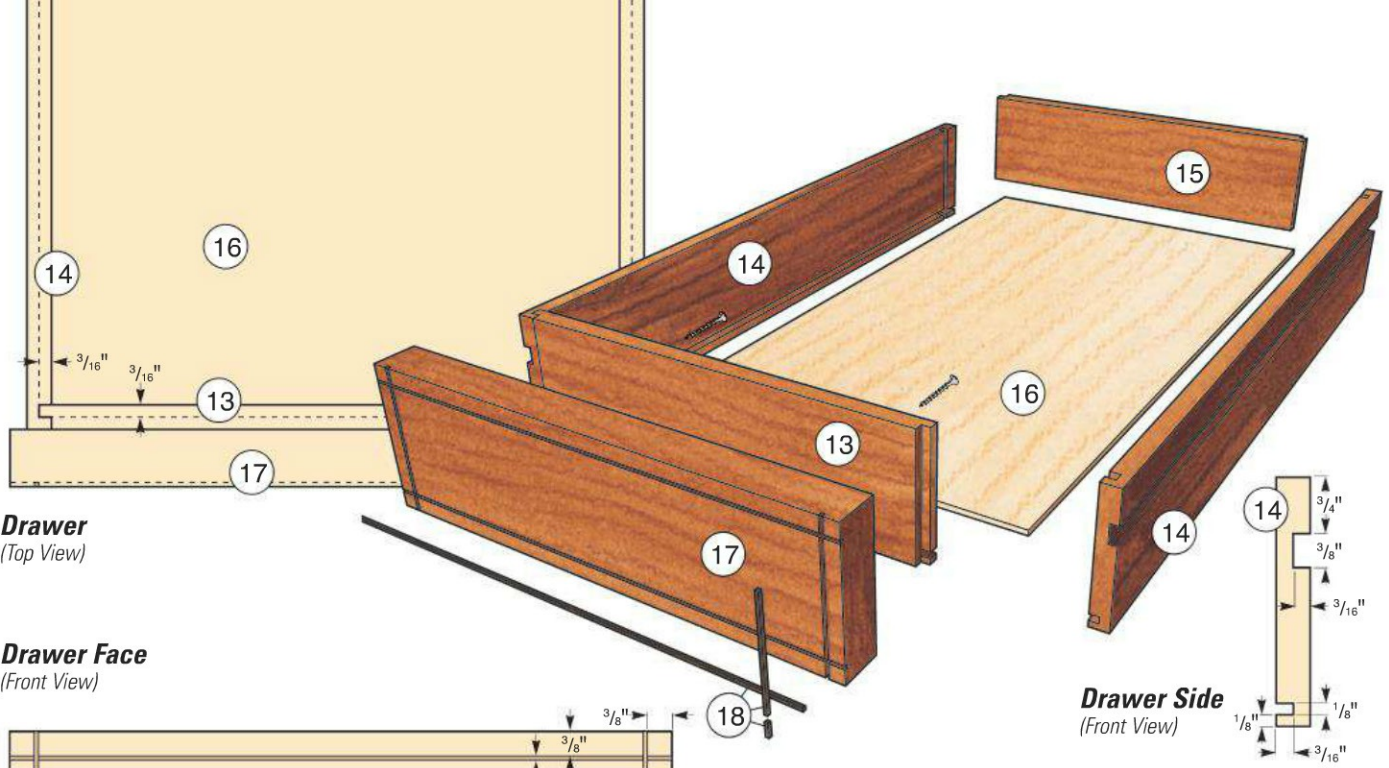
Speaking of which, use some scrap stock to make the nine wood buttons now, and drive a countersunk wood screw through each to fasten the desk top to the leg base. Be sure to position the buttons on the side aprons in a little bit from the legs so the top can expand widthwise with the seasons.



A scrap-made tapering jig with supports nailed in place held each leg blank securely for ripping the short tapers to shape.

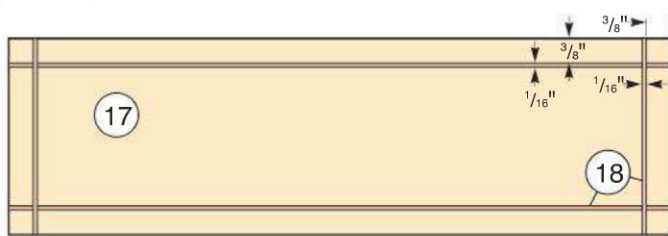


Make four grooves for leg inlay around the tapers by backing each leg blank up against the miter gauge and using the rip fence as a stop block.

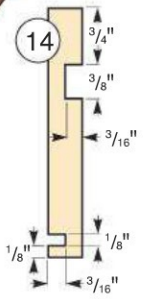


Drawer
(Top View)

Drawer Face
(Front View)



Drawer Side
(Front View)



MATERIAL LIST (DRAWERS)

	T x W x L
13 Drawer Fronts (3)	3/8" x 2 3/4" x 9 1/4"
14 Drawer Sides (6)	3/8" x 2 3/4" x 17"
15 Drawer Backs (3)	3/8" x 2 1/2" x 9 1/4"
16 Drawer Bottoms (3)	1/8" x 9 1/4" x 16 13/16"
17 Drawer Faces (3)*	7/8" x 3" x 10 7/8"
18 Drawer Face Inlay (1)	1/16" x 1/16" x 90"

* The three drawer faces are cut from the front apron.



In order to maintain a flowing grain pattern, the desk's drawers are cut with a thin blade from the front apron. The top fastens to the base with wood buttons (left). Their tongues fit into shallow grooves in the aprons.

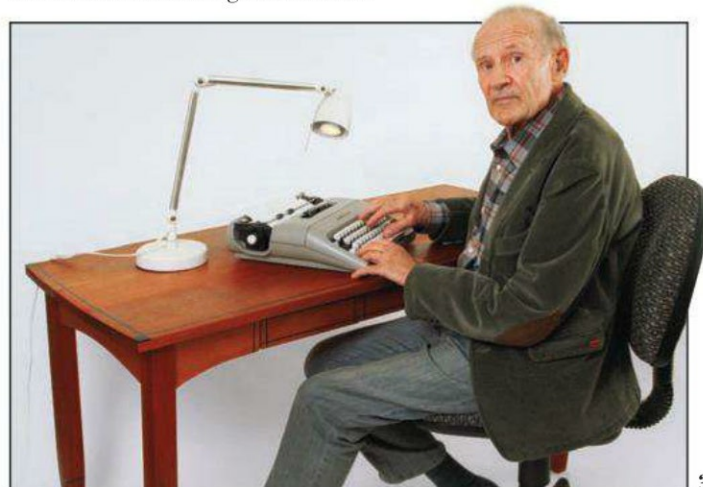
Adding the Runners and Drawers

The desk drawers are suspended from the desk top and slide along pairs of drawer runners with supports dadoed into them. Use scrap stock to make the runners and supports. Then turn your attention to the drawer boxes. You can construct these drawers with any joinery you prefer, but the parts are sized in the *Material List* to accommodate rabbit-and-dado joints (see *Drawing*, above). Cut the joinery, make slots for the drawer bottoms and assemble the three drawers with glue and clamps. When the joints cure, cut 1/8"-deep, 3/8"-wide slots along the drawer sides for the runners. Then flip the desk over and set the three drawers and their runners in place. Use 2" countersunk screws in elongated holes to attach the drawer runners to the desk top. Only after the drawer

boxes have been fitted and slide in and out smoothly should you attach the drawer faces. I didn't do this, and aligning the bands of inlay on the drawer faces after the drawers were in place was a tedious, time-consuming business. You can use short pieces of double-sided tape to position and hold the drawer faces in place temporarily, before fixing them permanently with screws driven from inside the drawer boxes.

There is no functional need for pulls with drawers this small since they are easily opened with a hand beneath the front edge. If you prefer the look of pulls, make a set using the same wood as the inlay in a style that suits your taste.

Simon Watts is a frequent contributor to Woodworker's Journal. He lives in San Francisco in the winter and on an island home in Nova Scotia during the summer.



Mortising Machine Stand

By Chris Marshall

This easy-to-build custom base unit gives your mortiser the crowning touches it deserves: task lighting, pullout workpiece supports, better access and drawer storage.





The author used just two lifting handles, but four (two per side) would be useful if you have a heavy mortiser needing two people to carry it. Use a Forstner bit, then a jigsaw to create the cutouts.



Install the drawer slide hardware before assembling the sides, divider and back panel on the base. The roller tracks would be much harder to install after you've undertaken the assembly.

Benchtop mortisers sure beat chisels and mallets, but their features can be a bit underwhelming. For one, their bases are low on a benchtop, making it tough to see what you're doing without bending over. Most models lack side supports to keep long workpieces from tipping off. They're ungainly to move around the shop, too. Grab the wrong spot when lifting the tool, and that feed handle can crack you in the kisser like you're stepping on a rake. If you lift from the base casting instead, the edges can be sharp and painful. Either way, it's not pleasant.

Well, friends, take heart: this project is designed to give your mortiser a helping hand. It features a pair of pullout support arms that extend the machine's "wingspan" up to about 4 ft. The drawer box raises the tool almost 9" off the bench for easier viewing when mortising, and a task light brings layout lines into sharper relief. Two drawers give you room for mortiser chisels and much more. Cutout handles offer comfortable lifting points, too. It's the souped-up base your mortiser really needs.



The author made a simple ripping jig to secure each dovetail extension strip for cutting its second beveled edge. Toggle clamps make for quick changeovers and keep fingers a safe distance from the blade.

Assembling the Carcass

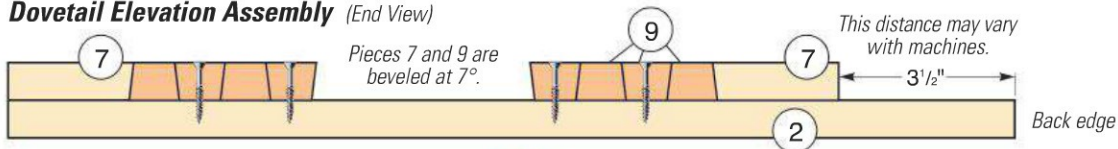
Baltic birch or other cabinet grade plywood are good options for the carcass parts of this project. Start by cutting your base (piece 1) to size and laying out the corner radii and handle cutouts according to the *Drawings* on page 42. Trim the corners round with a jigsaw or band saw. Bore two 1/4"-diameter through holes for the ends of each handle, then connect them by sawing away the waste in between. Head to your drum or spindle sander to smooth the curves and cutouts. Remove the remaining sharp edges with a 1/4" roundover bit in your router.

Follow the *Material List* dimensions on the next page to cut the top, sides, divider and back panel (pieces 2 through 5) to size. Finish-sand your carcass parts now, then screw the drawer slides (pieces 6) to the inside faces of the side panels and to both faces of the center divider. Be careful to position these roller tracks 3/4" back from the front edges of the panels in order to make room for the inset drawer faces. Once the slide hardware is in place, attach the back panel to the divider with countersunk screws, add the side panels so they cover the ends of the back

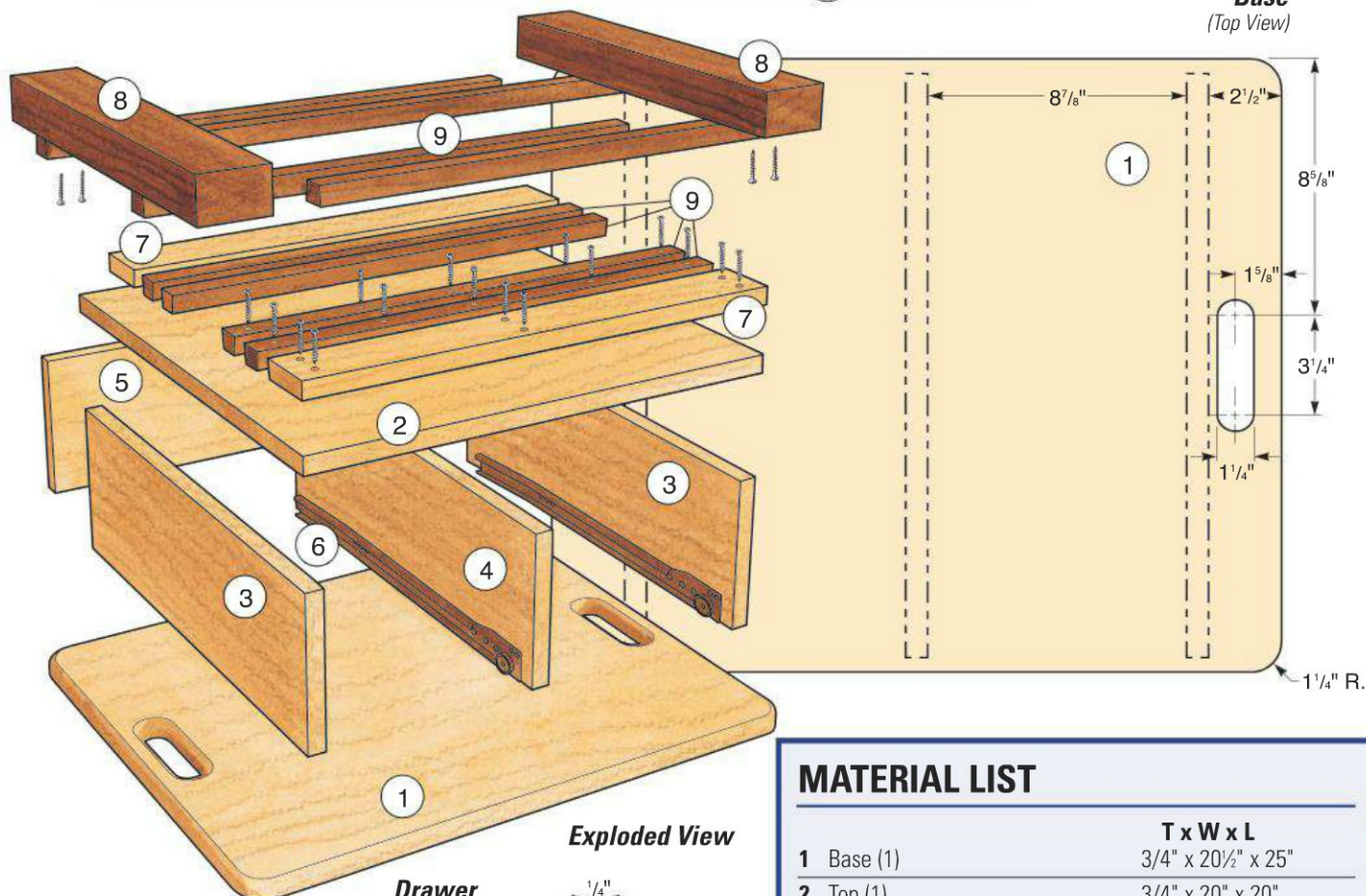


Arrange two groups of four dovetailed extensions against the machine bases with their bevels alternating and engaged. Fasten four strips to the carcass top to create "tracks" for the other four strips that slide.

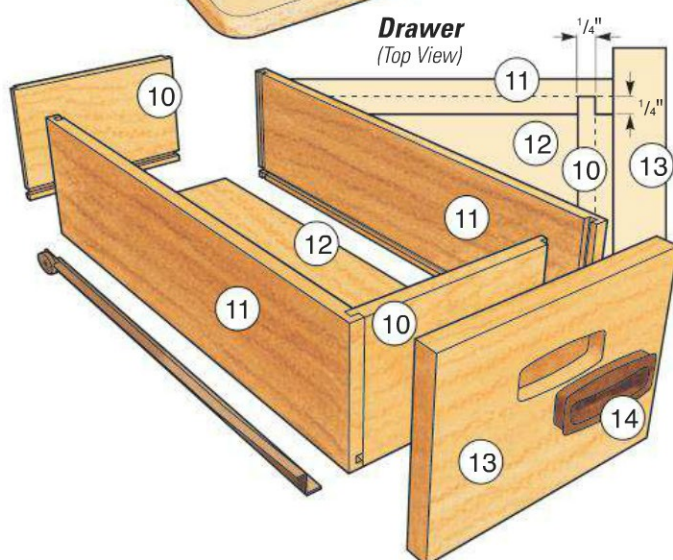
Dovetail Elevation Assembly (End View)



Base (Top View)



Exploded View



MATERIAL LIST

	T x W x L
1 Base (1)	3/4" x 20 1/2" x 25"
2 Top (1)	3/4" x 20" x 20"
3 Sides (2)	3/4 x 6 1/2" x 20"
4 Divider (1)	3/4 x 6 1/2" x 19 1/4"
5 Back (1)	3/4 x 6 1/2" x 18 1/2"
6 Drawer Slides (2 pr.)	18" Low profile
7 Machine Bases (2)	3/4" x 2 1/2" x 20"
8 Workpiece Supports* (2)	1 3/4" x 2 3/4" x 16 1/2"
9 Dovetail Extensions (8)	3/4" x 1" x 20"
10 Drawer Fronts, Backs (4)	1/2" x 5" x 7 1/2"
11 Drawer Sides (4)	1/2" x 5" x 18"
12 Drawer Bottoms (2)	1/4" x 7 1/2" x 17 1/2"
13 Drawer Faces (2)	3/4" x 6 1/2" x 8 5/8"
14 Drawer Pulls (2)	Wood/Recessed

* Adjust the thickness of these pieces to match your mortiser's base casting thickness, as this may vary with the model.

Mortising Machine Stand Hard-to-Find Hardware

The following supplies are available from Woodworker's Journal.

Recessed walnut drawer pulls (2) #22285 \$9.49 each
18" brown drawer slides (2) #34942 \$7.99 pair
24" snake light (1) #20174 \$47.99 each

To purchase products online, visit www.woodworkersjournal.com and click on the "Store" tab. Or, call 800-610-0883 (code WJ1321).

panel, and fasten this whole subassembly to the base with more screws. Center it between the handle cutouts and square it up carefully first. Fasten the top panel in place. The last step of this stage is to make and attach two plywood machine bases (pieces 7) to the top: they serve as spacers under the machine that allow the dovetailed support extensions to slide freely in and out. Notice in the *Drawings* above that the "inside" edge of each machine base piece is beveled at 7° to match the dovetailed extensions. Fasten the front base strip flush with the carcass's front edge; the rear base is inset 3 1/2" or where needed to suit the size of your mortiser's base casting.



The drawer box corners are assembled with simple rabbet-and-dado joints cut with a 1/4"-wide dado blade on the table saw (see inset). Grooves along the full length of the box parts capture the bottom panels.



Making the Sliding Arms

Each sliding arm consists of a thick workpiece support (piece 8) that matches the height of your mortiser's base casting. Mine is 1 3/4"; yours might be different, so adjust the part thickness if necessary. These attach to pairs of dovetail extensions (pieces 9). Four more dovetail extensions fasten to the carcass top and serve as tracks for the arms to slide in and out. The *Exploded View Drawing* makes this part arrangement more clear.

Prepare the two workpiece supports by laminating thinner stock or from single pieces of thicker material. The safest way to bevel-rip the dovetailed edges of the eight extension strips is as follows: start with 20"-long sticks of 1 1/2" or wider stock, and bevel-rip one edge of each to 7°. Then, make a simple sled-style ripping jig as shown in the center right photo on page 41 to rip the second dovetailed edges safely. Mount several toggle clamps to the jig to keep your fingers out of harm's way. Fashion the top piece of your jig with a 7° bevel along one edge that forms a complementary fit with the beveled edges of the strips.

Once they're sawn and sanded smooth, set two groups of four dovetail extensions against the machine bases with all of their bevels interlocking. Now, counting the dovetail extensions from the front of the project, fasten the second, fourth, fifth and seventh strips to the carcass top with 1 1/4" countersunk screws. The remaining loose strips should slide with a bit of friction but not force between the fixed dovetailed "tracks." Attach one workpiece support to the ends of the first and sixth sliding extensions; position it so its front end is flush with the front of the drawer box. Align and screw the other workpiece support to the third and eighth extensions. Two or three screws per joint will secure these arm parts.

Adding Drawers and Finishing Touches

The drawer boxes for this project couldn't be more straightforward in construction: 1/4" x 1/4" rabbet tongues on the ends of the drawer fronts and backs (pieces 10) fit into corresponding dadoes cut in the drawer sides (pieces 11) to form simple corner joints. Next, cut 1/4" grooves along the bottom inside faces of all of these parts to fit the drawer bottoms (pieces 12). Sand the box parts up to 180-grit, and glue them



Pockets for recessed pulls in the drawer faces are easy to make: trace the pull shape, remove most of the waste with a Forstner bit, then refine the shape with a trim router outfitted with a small straight or spiral bit.

together. When the glue cures, install the remaining drawer slide hardware and test the action of the drawer boxes in their openings. Now cut two drawer faces (pieces 13) from some leftover project plywood to fit the drawer box openings. Size them to leave 1/16" of clearance all around. I installed the recessed drawer pulls (pieces 14) by tracing their shape onto the drawer faces, boring out most of the waste with a large Forstner bit and then cleaning up the rest of the waste with a trim router. Finish-sand the drawer faces, and glue the pulls into place. Mount the faces to the drawer boxes with screws.

All that's left to do on this custom shop project is to apply a durable topcoat, bolt your mortiser to the machine bases and add a task light in back. I hope you'll agree that this shop-built stand will help you get the best from your benchtop mortiser.

Chris Marshall is a senior editor of Woodworker's Journal.



Dovetailed Puzzle Box

By Bill Hylton

This dovetailed puzzle box is challenging to make and fun to solve!

This small puzzle box doesn't eat up a lot of material, it's fun and a little challenging to make but won't keep you in the shop for weeks, and it will appeal to anyone who tries to open it.

It's symmetrical, with interlocking dovetail slides and keys. The sides are alike, as are the ends and the top and bottom. Which is really the top? How do you get it open? The answer may not be immediately obvious. For now, don't try to solve it. Think about getting it made.

You'll only need a couple feet of stock, depending on board width. So rummage through your stashes of scraps too good to toss. Joint and plane all the stock for the box to a 1/2" thickness. Rip the sides and ends to width, and crosscut these four parts to length. Make sure you have some decent sized scraps, thickened along with the good stuff, to use for dialing in setups. Set the rest aside for now.

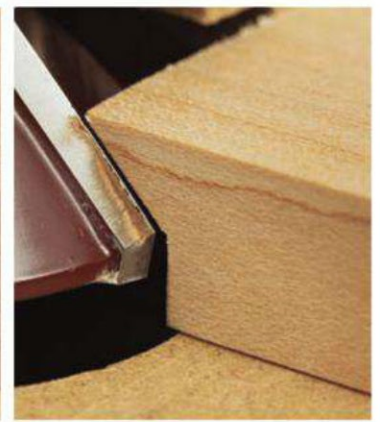
Making Rabbeted Miter Joints

I elected to use rabbeted miter joints to assemble the sides and ends. The joint's benefits are its clean appearance, its improved stress resistance over a plain miter joint, and particularly its ease of assembly. You can cut mitered rabbets on the table saw, but it's less intimidating to make them on the router table. You'll need a bit to cut rabbets and a chamfering bit to add the mitered ends.

The sequence, as shown in the photos (above right), is as follows: First, you rabbet the parts. Then you bevel the ends of those rabbets — in effect, mitering them.

The depth for all the rabbets is half the stock thickness, in this case 1/4". Put a straight bit in the router and carefully adjust the depth of cut to 1/4". Make a test cut on a piece of the setup scrap; rip the scrap in two and put the pieces





Confirm the accuracy of your setups with test cuts: *Start the corner joints by adjusting the rabbet bit height as you would for cutting a shiplap. For half of each joint, cut a rabbet as wide as the mating piece is thick. The other half of each joint requires the width of the rabbet to match its depth (left photo). Bevel the ends of both the narrow and wide rabbets with the same setup using a chamfer bit (center and top right photos). The result is a miter with the registration benefits of a rabbet (right).*

together in a shiplap. The faces must be flush with the bottoms of the rabbets tight together. If you've got a gap between the rabbets or if the faces aren't flush, tweak the bit height and cut a new test. Then set the fence for the first round of rabbets.

The rabbets cut across the ends of the box sides are half the stock thickness in width, or 1/4". Slide the fence into position, and use the final depth-of-cut test piece as a gauge in setting it. You want only enough of the bit exposed to cut as wide as the depth. Again, confirm the accuracy of the setup with test cuts.

Rabbet the ends of both side pieces, backed up with a good-sized pusher to guide the workpieces through the cuts.

Now alter the setup for rabbeting the box end pieces. These rabbet widths match the stock thickness exactly. Using an end piece as a gauge, shift the fence to expose more bit. Once again, confirm the accuracy of the setup with test cuts. That done, cut rabbets across the box ends.

Beveling the Rabbets

The bevels (or miters) are routed with a chamfering bit. When you fit the bit in the router, be sure to extend it far enough out of the collet. The bottom of the cutters must be 1/4" above the tabletop to mill the bevels (see center and top right photos). As you adjust the height of the bit, use a workpiece to gauge the precise elevation. The terminus of the angled cutting edge must align with the rabbet bottom. Similarly, adjust the fence so only enough of the bit is exposed to cut the thickness of the rabbet projection.

Confirm your setup using the final rabbet test-cut scraps. Make any necessary adjustments before cutting the good parts. Back up the cuts to prevent blowouts.

After sanding the parts and checking

the fit, I assembled the box with glue, clamping it with a band clamp and four shop-made corner blocks. To make such blocks, cut a rabbet in a 1 1/4"-square strip, then chop it into four pieces, each about 2" long. Wax the faces of the rabbets so the blocks don't get glued to the box. As you tighten the band, measure the diagonals to ensure the box is square — you may need to coax it.

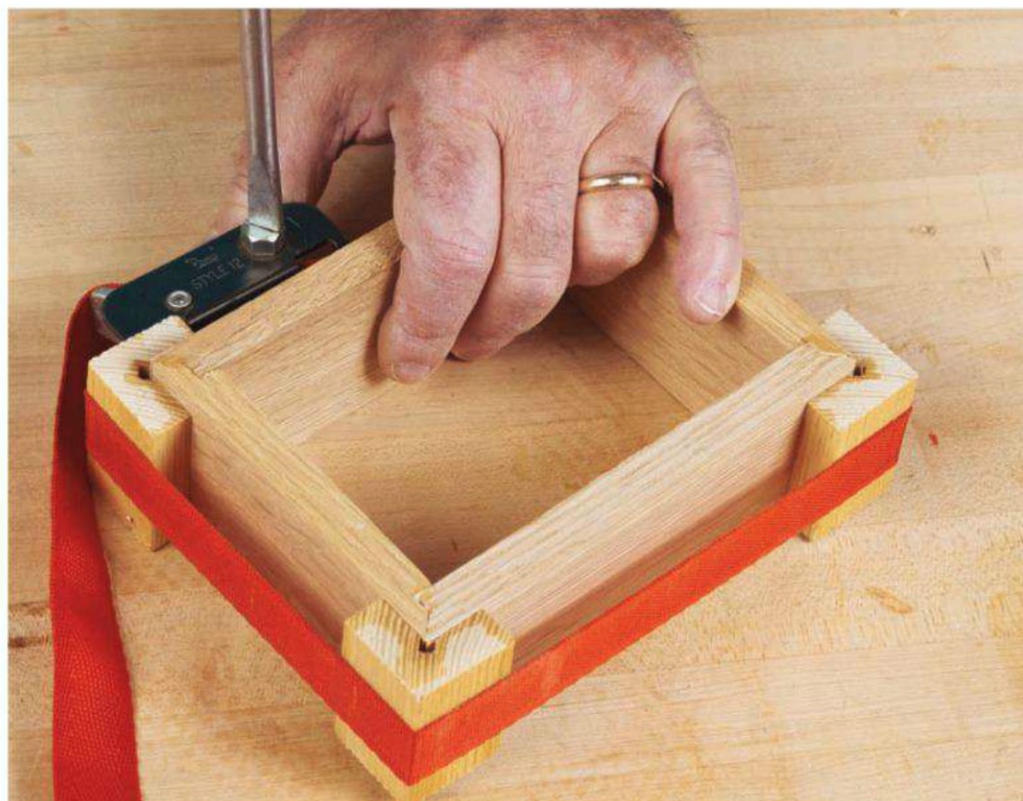
Make Rabbeted Tops and Bottoms

After the glue sets, pop off the band and corner blocks, clean up the edges of the box, and rip and crosscut the top and



bottom to fit the box you've now got. I cut the two parts using a cutoff sled on the table saw, and I used the box assembly to set a stop for ripping, then crosscutting the parts accurately.

Cut 1/8"-deep, 1/2"-wide rabbets around the top and bottom (see *Drawings*), so these parts set slightly into the box. Glue the bottom to the box (not the top).



The author used shop-made corner blocks and a band clamp to glue the box together. Don't let appearances fool you: check the assembly's squareness carefully and adjust it before the glue sets.



Clamp back-up boards to the top (unglued) and bottom before making the first slot cuts in the box ends. Three or four passes, flipping the box and moving the fence away from the bit each time, completes each wide slot.

Rout Slots, Slides and Keys

I routed all the dovetail slots, grooves, slides, and keys with a 3/4" 14° dovetail bit. I cut the wide slots in the box ends first, then routed and fitted slides to them. Put the bit in the router and adjust the cut depth to 3/8". Plan to make the slots about 1 3/4" wide (precision here is irrelevant). Set the fence 1 5/8" from the tip of the cutter for the initial cut. Using its rabbet, position the top on the box. To

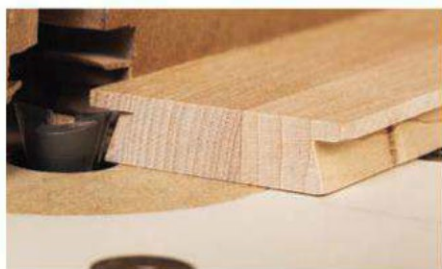
prevent blowout damage, cut two pieces of scrap to cover the top and bottom. A clamp holds the package together and ensures you slide the same side of the box along the fence on each cut.

Make a first pass, routing a dovetail groove through one end of the box. Then roll the box end-for-end and make a duplicate groove through the other end. Adjust the fence about 5/8" further away from the bit and make second passes

though both ends, widening the slots. A second fence adjustment and third cuts should be sufficient to complete the slots.

To make the slides, cut a strip of 1/2"-thick stock about 2" wide and 7" long. Leave the depth-of-cut setting unchanged, but move the fence to house the bit almost completely. A shallow first pass along each edge of the blank establishes the dovetail angle but leaves a shoulder above the bit to bear against the fence. A multi-pass cut-and-fit process, shifting the fence, whittles down the dovetail section without affecting the overall (fence-bearing) width of the blank.

Once the blank fits easily into either slot, cut it into two slightly overlong slides. Clamp the box in your bench vise, with a scrap tucked in to hold the slide in place, as shown in the photo below. Plane down the slide flush with the box end's face. Turn the box over and repeat the operation to finally fit the second slide. Sand the ends of the wide slides flush with the top and bottom of the box. Glue the slides to the box top (and only to the top, not to the box itself).



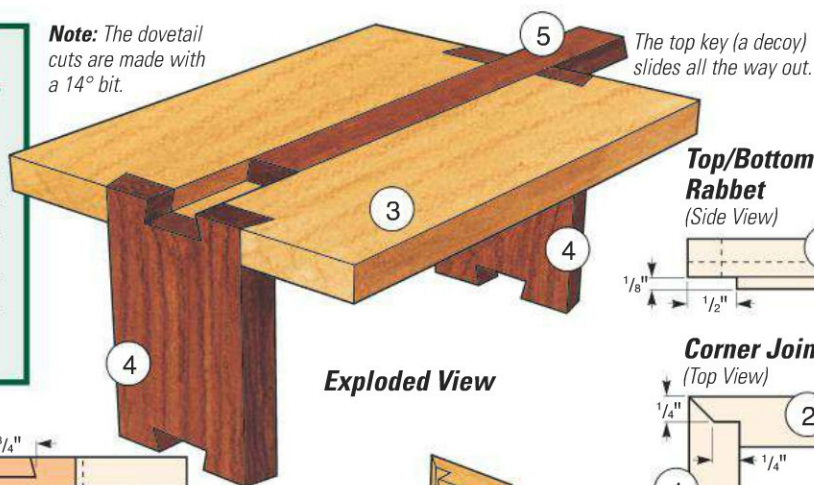
Make the slides with the bit setting unchanged from routing the slots. If you use 1/2" stock, a shoulder is formed that rides along the fence, allowing you to progressively adjust the fence and cuts while narrowing the slides (far left, top). Eventually, the dovetail portion of the blank will be narrow enough to fit into the slots (far left, bottom). Plane the fitted slides to final thickness by hand (left), clamping the box — slide in place — in a bench vise with a scrap against the slide to immobilize it.

MATERIAL LIST

	T x W x L
1 Sides (2)	1/2" x 2" x 6"
2 Ends (2)	1/2" x 2" x 4 1/2"
3 Top and Bottom (2)	1/2" x 4 1/2" x 6"
4 End Slides (2)*	3/8" x 1 15/16" x 2 3/4"
5 Top and Bottom Keys (2)*	1/4" x 3/4" x 6"
6 Locking Dowel (1)	1/8" x 1/8" x 3/8"

* Fit to the dovetailed grooves

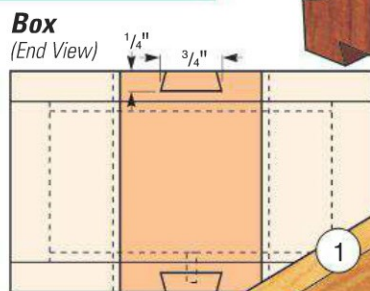
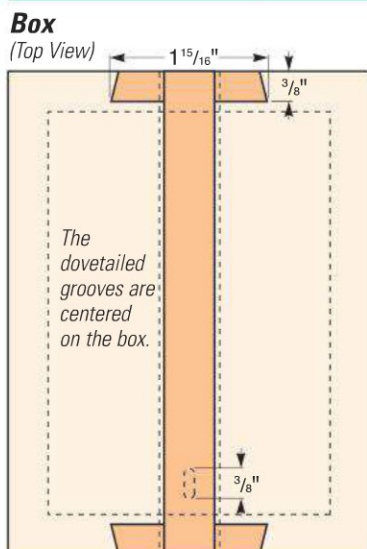
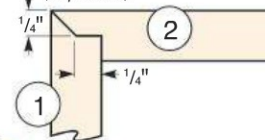
Note: The dovetail cuts are made with a 14° bit.



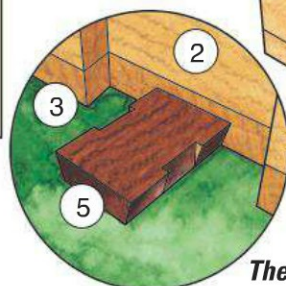
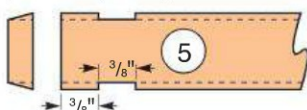
Top/Bottom Rabbet
(Side View)



Corner Joint
(Top View)



Bottom Key Notch Detail
(End and Top Views)



The Key to the Puzzle

Pare a notch in the bottom key's dovetailed edge. This allows the end slide to clear the bottom key. The locking dowel stops the key in the proper position.

With them in place, you can now rout the key grooves across the box top and bottom. Milling them repeats the earlier process for routing the wide slots. Clamp scrap against the wide slides to prevent exit damage. Lower the bit to cut only 1/4" deep, and set the fence to locate the groove in the center of the box. Plow grooves across the box top and bottom.

Make the keys the way you did the wide slides. Resaw or plane a 1"-wide strip of stock to 3/8" thick. Rout the edges and fit the keys into the grooves. Plane them

flush and trim them to exact length.

I applied Waterlox for finish, allowing it to dry for several days before rubbing it out with wax and #0000 steel wool.

Solution Step of Construction

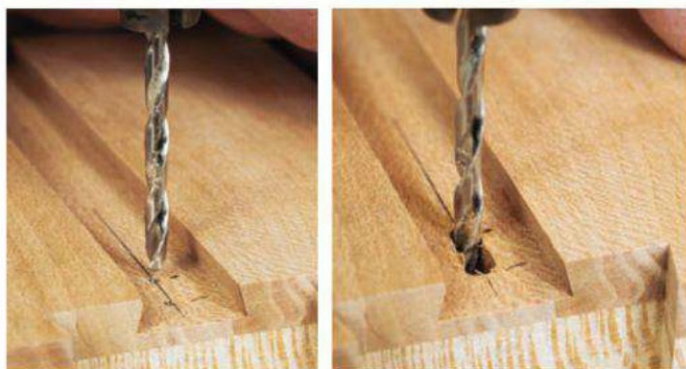
The solution to the box's puzzle — how to open the thing? — is in the limited movement of the bottom key. It moves clear of one slide, but then stops with its far end sticking out. That movement aligns tiny notches in the key's edges with the dovetail notch in the adjacent slide. Pull the top

up, and the slides (they're glued to the top, remember) pull up and off with it.

The key's movement is governed by a 1/8"-dia. dowel pin projecting into a short slot in the box bottom. Fit it by pulling the key out of the bottom and laying out the ends of the slot on the centerline of the dovetail groove. Drill the ends of the slot with a 3/16" bit and then waste the material between them. Reinsert the key, aligning its ends flush with the box ends, then transfer the near slot end location to the key with a transfer punch or drill bit. Move the key to what will be the limit of its travel and score its edges to mark the two notches that must be pared. Pull out the key and drill a stopped 1/8"-dia. hole at the mark, then pare off the dovetailed edges. Reinsert the key, glue the pin into its hole, and fit the top and slides in place.

I left the key in the top unglued, as a kind of diversion. The key comes out, but the box just doesn't open!

Lay out the slot for the locking dowel in the bottom dovetail groove (left). Mark the ends with an awl, then drill two holes through the bottom. Drill holes between the first two, and slide the box along the fence to "rout" it smooth (right).



Bill Hylton is a woodworker and author of *Woodworking with the Router*.

Shop Test

Torture Test: Nine Heavy-Duty Drill/Drivers

By Sandor Nagyszalanczy

Our resident tool expert takes nine big drill/drivers for an exhaustive test drive and picks a favorite.



A big drill with a modern 4-pole or brushless motor fed by a powerful lithium-ion battery churns out enough torque to drill monster holes and drive the longest screws. Plus, the high amp-hour ratings of the battery packs that come with these tools allow you to do enough work on a single charge to vanquish even the most challenging projects.

So, which one should you buy? There are a number of models in the 18- to 21.6-volt range currently on the market, and my challenge from the *Journal* team was to evaluate nine of these drills and pick my favorite. To maintain an “apples to apples” comparison, I’m not including drills that come with lower-capacity slim-pack-style batteries, such as Craftsman’s C3 35704 or PORTER-CABLE’s PCKK600LB. Although these are also plenty powerful, they just don’t have the extended run time of the heavy-duty models featured in this article.

The Performance Trials

In addition to making observations about each drill/driver’s features and ergonomics, I put each drill to all the usual home-

shop kinds of tasks — drilling holes in wood and metal, driving screws, etc. But I also wanted to probe the outer limits of performance for each model. Therefore, I subjected the drills to a series of torturous tests which pushed each one to the very edge of (or, in some cases, beyond) the limits of its abilities.

In the first test, I wanted to see how much maximum torque each drill could deliver, so I drilled a series of 1"-diameter holes through seasoned lumber — the kind of job you face when running new electrical circuits into a family room. I chucked up a not-too-sharp 1" Forstner bit (remember, this is the real world) and set the drill to its highest gear/speed range and disengaged its clutch. For the next trial, I switched the drills into low gear and chucked up a 1" self-feeding auger bit — the kind electricians use with super-heavy-duty corded drills. This bit really pushes cordless drills to their limit, as the bit pulls itself into wood very aggressively. I gave each drill 1 to 10 points based on its overall drilling performance.

For my second test, I checked how much run time each drill/driver could deliver on a single battery charge. About the toughest test I could come up with was to drive large lag bolts; the kinds you might use to mount construction hardware when building a deck or shed. I fitted each drill with a 1/2" socket driver, then ran lag bolts into 1/4" pilot holes drilled into construction-grade fir 4x4s. I counted the total number of bolts

each drill was able to drive before it ran out of juice, and I awarded points accordingly. I also awarded bonus points to the speediest performers.

Once I had run down the battery packs, I wanted to see how long it would take to recharge them. After waiting for each pack to cool (important for long battery life), I set it into its charger and recorded the time it took to reach a full charge. I then gave each model points: 10 for the fastest charging time, and proportionally less for each of the others.

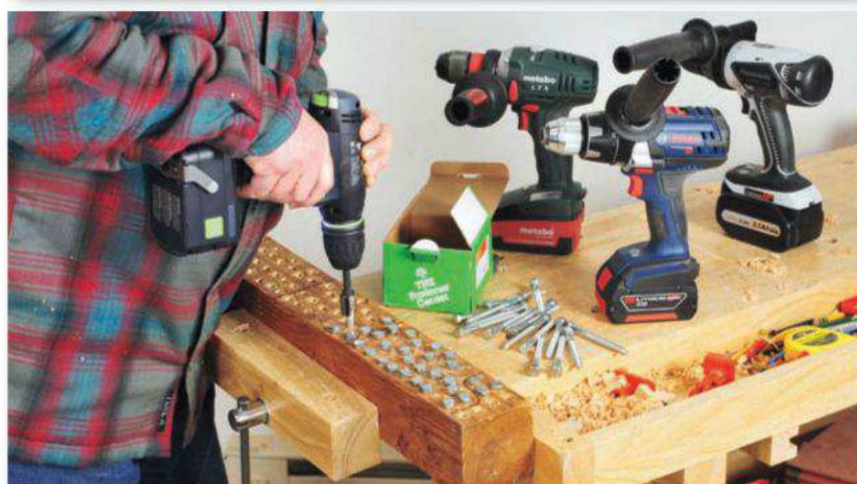
Bosch DDH181

In your hand, the Bosch comes across as being stout and hefty but reasonably compact and well-balanced. Its grip isn't too thick or too thin and fit my medium-sized hand very well. Initially, I found it a bit tough to operate the drill's reversing switch with my thumb. But I quickly got used to it. The trigger action is responsive when ramping the tool up from 0 rpm — really important when setting screws, as too much startup torque makes for stripped screw heads. The motor is responsive, without too much lag when triggering the drill on. The unit's 25-position (plus a drill setting) clutch selection ring is moderately stiff but easy to set and feels very positive. Their two-position gear selector was one of the easiest to operate in this test group.

The Bosch has a nice all-steel chuck, with a floating nose cone designed not to mar the work surface, should the chuck make contact during



A 1"-dia. self-feeding auger bit pushes a cordless drill to its limits.



Each drill drove as many 5/16" lag bolts as possible on a single charge.

Test Results

Make and Model	Drill Power Test	Driving Longevity Test/Speed Bonus Points	Recharge Time/Speed Points	Performance Points (Total)
Bosch DDH181	6	6.5/0	85 min./3	15.5
DeWALT DCD980L2	8.5	7.5/2	57 min./6	24
Festool T18+3	9	10/1	64 min./5.5	25.5
Hitachi DS18DBL	5	7.5/0	46 min./7.5	20
Makita LXFD03	6	5.5/0	26 min./10	21.5
Metabo BS18 LTX Quick	4	6/0	63 min./5.5	15.5
Milwaukee 2610-24	10	5.5/1	67 min./5	21.5
Panasonic EY7460LZ2S	3	3.5/0	74 min./4	10.5
RIDGID R8611501K-X4	8	6/1	41 min./8	23

Points are based on a scale of 1-10

drilling or driving (a feature also present on the Festool, DeWALT and Metabo). It's also quite stubby, which helps keep the overall top length down — a good thing when working in confined spaces.

The Bosch has a stout feel in your hand. Unfortunately, that didn't translate into good scores in my performance tests, where the DDH181 was only an average performer. I was particularly

unimpressed by the speed with which the otherwise torquy Bosch drove fasteners: Top speed in low-gear is only 380 rpm. Its battery charger also disappointed, taking an incredible hour and twenty-five minutes to fully top up a depleted pack.

The Bosch DDH181 features a sturdy and durable all-metal tool-less chuck.



Bosch DDH181

Street Price: \$280

Volts: 18

Motor Type/Geared Trans. Range: 4-pole/2

Clutch Settings/Separate Drilling Selector: 25/No

Built-in Light?/Number of LEDs: Yes/1

Net Weight (w/ power pack): 4 lbs. 11.3 oz

Web/Phone: www.boschtools.com / 877-267-2499



DeWALT DCD980L2

Street Price: \$280

Volts: 20 max

Motor Type/Geared Trans. Range: Brush/3

Clutch Settings/Separate Drilling Selector: 22/Yes

Built-in Light?/Number of LEDs: Yes/1

Net Weight (w/ power pack): 5 lbs. 3.7 oz

Web/Phone: www.dewalt.com / 800-433-9258



Quik-Link takes you directly to the web page on which these products appear! No navigation necessary ... just go to woodworkersjournal.com and click on the Quik-Link icon shown above.

DeWALT DCD980L2

The big yellow and black DeWALT drill/driver feels extremely solid in your grip, but it's also a handful (third heaviest in the test). It's the only drill in the test group that has a three-speed geared transmission. Unlike the majority of drills which top out at 1,600 rpm, this unit delivers a whopping 2,000 rpm maximum speed. This is very useful when drilling small holes in metal and allows you to use drill accessories such as rotary rasps. The drill's all-metal

a separate selector, you can leave the clutch on the desired setting and still switch to drilling (with full power).

If I had to pick a phrase to describe the DeWALT's performance, it would be "rock-solid." Both in drilling and driving, the DCD980L2 was right at the top, bested only by the Festool. Not only did it hold its rpms well during my brutal lag bolt driving test, but its higher-speed low gear also drove the bolts faster than any other drill. And, its battery recharge time was better than average.

from damage. They also operate the T18+3's unique clutch: With the drill/drive selector switch in the drive position, an adjustable dial determines the amount of torque delivered to the bit. When the set torque is reached, the drill simply beeps and shuts off, thus saving energy, for longer battery run time. This electronic clutch has a very good range of torque delivery, from very low settings that allow you to sensitively set tiny screws in soft woods, to high settings powerful enough to drive the biggest screws.

Because the T18+3 is so quiet and smooth in use, my initial misperception was that it wouldn't have the power of other models (I had the same feeling the first time I drove a Tesla electric sports car). It's also the lightest drill in this

Continues on page 52 ...



A dedicated drill/drive selector, as featured on the DeWALT DCD980L2, makes it easy to switch functions without resetting the clutch.

chuck feels very strong, and its jaws feature serrated carbide inserts which grip bits with authority. The motor reversing switch is well placed, but it's a little stiff to operate. The side handle is easy to attach and remove.

I'm a big fan of a separate drill/drive selector on a drill. It can save time when you want to switch quickly from drilling to driving. By having

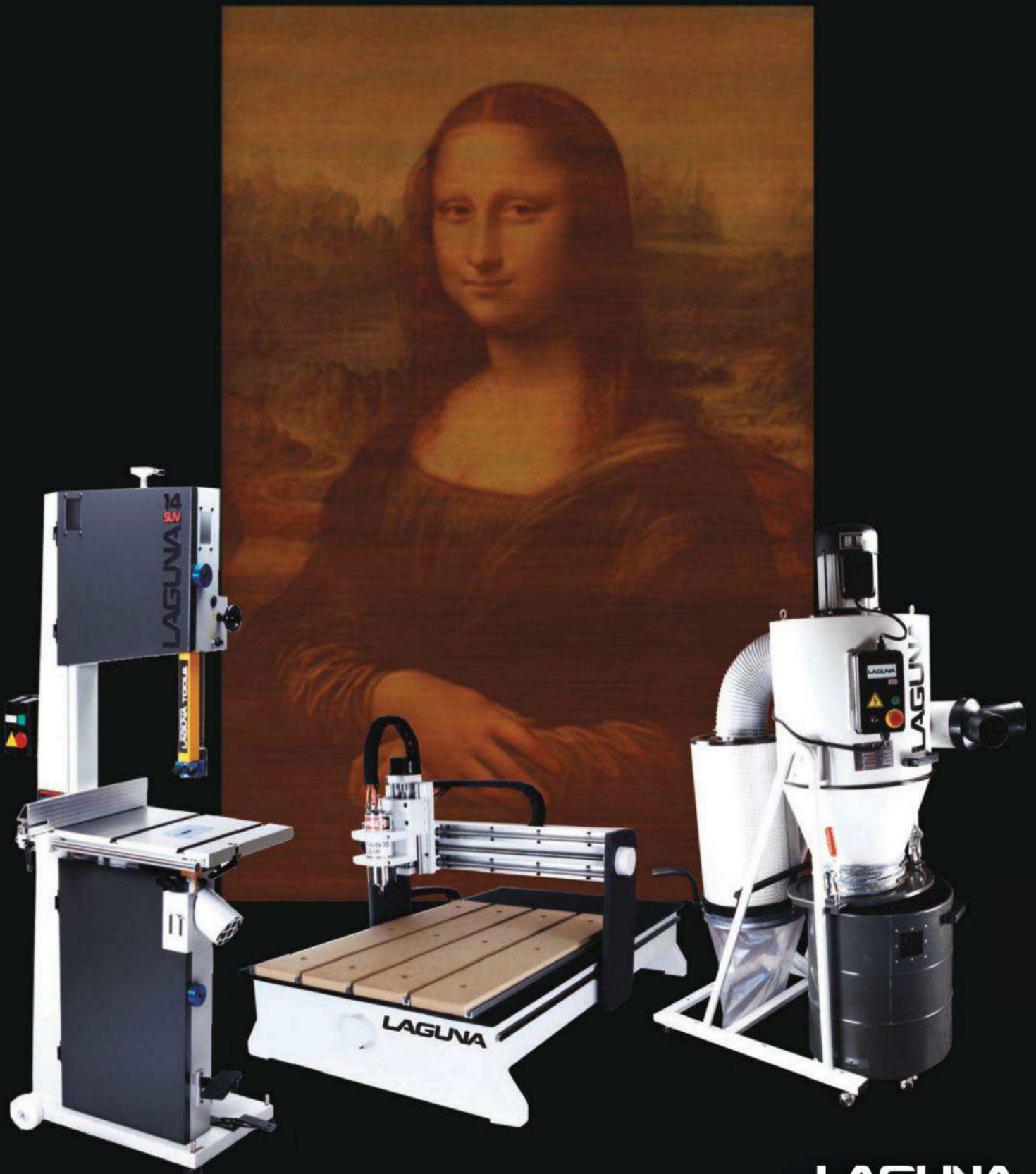
Festool T18+3

"Sophistication" is the word that came to my mind when I first used the Festool T18+3, with its quick-change chuck system and brushless motor managed by electronically commutated technology (EC-TEC). With no commutator or brushes, there are fewer motor parts to wear out. The electronics monitor battery voltage, temperature and power output, to optimize performance and protect the tool

Remove the regular chuck, and the Festool accepts right-angle, eccentric, quick-change and screw-depth-setting accessories.



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Shop Test continued

Festool T18+3

Street Price: \$625

Volts: 18

Motor Type/Geared Trans. Range: Brushless/2

Clutch Settings/Separate Drilling Selector: 25**/Yes

Built-in Light?/Number of LEDs: No

Net Weight (w/ power pack): 4 lbs. 3.3 oz

Web/Phone: www.festoolusa.com / 888-337-8600



** Clutch torque limited electronically



The T18+3 features a unique electronic clutch that has an adjustable dial for selecting maximum drive torque.

group. But during my drilling and driving trials, the Festool proved to be an absolute stellar performer, delivering top scores in both tests. It was especially impressive during the driving longevity test, where it drove significantly more lag bolts than its nearest competitor. Given the torque, one thing I missed was a side handle: none is provided nor available as an accessory.



A button at the base of the Hitachi drill changes speed ranges electronically.

Hitachi DS18DBL

At first glance, you might mistake Hitachi's DS18DBL as a "compact" drill model: Its brushless motor is more

trim than its sibling, the DS18DL, which is notably larger, yet delivers less motor torque. Like the Festool T18+3, the DS18DBL uses electronics to take advantage of the brushless motor's capacities, but in a

unique way: A small button just above the Hitachi's battery pack selects one of four electronically controlled speed ranges. A segmented LED readout shows which speed is selected. Because the DS18DBL also has a two-speed mechanical gearbox, that means that the drill offers eight different speed ranges. Hitachi's "digital transmission" limits the amount of current running to motor. You can dial down the power and tackle tasks on a single charge. Unlike the Festool drill, which uses electronics to limit its maximum torque output, the DS18DBL uses a traditional mechanical clutch and brake.

In use, the Hitachi is pleasurable to run. Its pistol grip is thinner than most other models, and its rubber overmolded surface is comfy to hold. Trigger response is crisp and sensitive, and direction reversal is quick and positive. The drill's 22-position mechanical clutch ring isn't difficult to turn, but settings don't click in all that positively.

Unfortunately, the Hitachi didn't do as well in my

performance tests as some of the other drills. It delivered decent run time for the lag bolt driving test, but ran more sluggishly under heavy load than the best performing models. The Hitachi was particularly weak during the hole drilling test, slowing noticeably when boring with the auger bit.

Makita LXFD03

The LXFD03 features sturdy construction, twin LEDs mounted just below the side handle mount and a good amount of shock-absorbing rubber overmold on the back end of the body. The Makita's side handle is easy to install and remove and is long enough to offer good control.

I found the LXFD03 to be a solid performer. I liked its quick trigger response but found the reversing switch a tad too short: I couldn't use the side of my index finger to press the switch when shifting from reverse to forward direction

(like I usually do with a cordless drill). I could do it by changing my grip slightly, but this took some getting used to. Also, the Makita's clutch and drill/drive selector rings are relatively narrow, which makes adjustments a little more challenging, especially if you're wearing work gloves.

Since Makita's published maximum torque numbers for the LXFD03 are high (850 in. pounds), I was a bit surprised by this drill's somewhat lackluster performance in both my drilling and driving tests. Whenever I pushed the

Continues on page 54 ...



Makita's sophisticated battery charger replenishes a spent pack in less than a half hour.

Makita LXFD03

Street Price: \$279

Volts: 18

Motor Type/Geared Trans. Range: 4 pole/2

Clutch Settings/Separate Drilling Selector: 21/Yes

Built-in Light?/Number of LEDs: Yes/2

Net Weight (w/ power pack): 5 lbs. 2.3 oz

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Shop Test continued

Metabo BS18 LTX Quick

Street Price: \$310

Volts: 18

Motor Type/Geared Trans. Range: 4 pole/2

Clutch Settings/Separate Drilling Selector: 7/No

Built-in Light?/Number of LEDs: Yes/1

Net Weight (w/ power pack): 4 lbs. 10.8 oz

Web/Phone: www.metabo.us / 800-638-2264



Milwaukee 2610-24

Street Price: \$330

Volts: 18

Motor Type/Geared Trans. Range: 4 pole/2

Clutch Settings/Separate Drilling Selector: 24/Yes

Built-in Light?/Number of LEDs: Yes/2

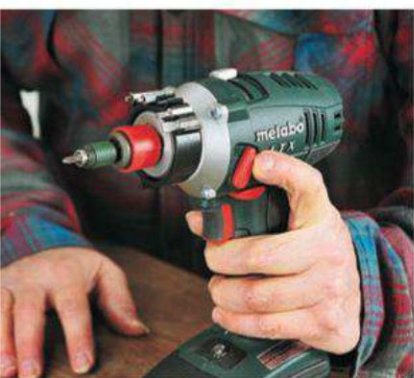
Net Weight (w/ power pack): 5 lbs. 8.3 oz

Web/Phone: www.milwaukeetool.com / 800-729-3878



drill hard, it bogged down a bit, although it never stalled completely. One quirk of the Makita was that it generated lots of motor sparks during routine use, and exuded a bit of a hot electrical smell.

In the recharge time test, the Makita simply smoked the competition. Its “musical” battery charger (that plays a user-selectable tune when the charge is complete) replenished an empty pack in a blazing fast 26 minutes — less than half the time of the majority of other chargers.



Levers on both sides of the Metabo drill let you change gears without letting go of the grip. With its chuck removed, the drill accepts a quick-change bit holder.

Metabo BS18 LTX Quick

Made in Germany, the Metabo is an unusual European drill closest to the Festool in its overall design approach. Like the T18+3, the Metabo BS18 has a very compact body and an innovative removable chuck. With the standard chuck removed, you can mount a quick-change bit

holder or mount a hex-shanked drill or driver bit to the end of the motor shaft itself. The latter allows the BS18 LTX to work in extremely tight spaces; a big plus for home DIY projects and cabinet installations.

In lieu of a clutch selection sleeve behind the chuck, the Metabo features a simple lever mounted atop the body. Sliding the lever sideways lets you choose between seven detented clutch settings and a no-clutch drilling function. The clutch delivered plenty of power when driving large screws, but its lowest setting delivered too much torque when tackling a sensitive job, like setting 1/2"-long #6 screws into softwoods. I also had a small problem when gripping the top of the Metabo's body, as I'd occasionally inadvertently change the position of the clutch selector. The BS18's gear speed selector is a pair of levers on both sides of the drill's motor housing. It's easy to operate by righties or lefties, and with a little practice, you can change speeds with the same hand that's gripping the drill.

Although I liked the Metabo's balance and compact body size, I was somewhat underwhelmed by its performance. Despite having plenty of torque for average wood shop tasks, it didn't quite have the oomph of some of the other drills, especially during my drilling power test.

Milwaukee 2610-24

At 5 pounds, 8.3 ounces, the Milwaukee 2610-24 is the heaviest drill in this test, but it is well-balanced and feels good in use, with a comfortable overmolded handle and well-placed reversing switch. It's a smooth running drill, generating very little vibration even at top rpm. I loved the feel of the 2610-24's clutch adjusting collar; each setting clicks in both easily and very positively. However, I found that even on its highest setting, the clutch cut out at lower torque than I would've liked. Set on their highest clutch settings, all the other drills were able to fully drive 3"-long, #10 wood screws, while the Milwaukee fell just a little short. I did like its drill/drive selector ring, which is easier to set than the ring on the DeWALT. I can't say the same for its gear selector, which was stiff to slide.

The Milwaukee drill runs on “Red Lithium™” battery packs that are reputed to operate in extremely low temperatures at which most Li-ion-powered tools barely run. The pack features a fuel gauge, but the small test buttons are very stiff and hard to push. During recharges, the four LEDs on the fuel gauge light in turn; more lights mean the pack is closer to a full charge — very helpful (the RIDGID's charger



A detachable side handle is a very desirable accessory for a heavy-duty drill that produces lots of torque, but doesn't deliver all of it even with the clutch on its highest setting.

also does this). Milwaukee is also apparently the only company that uses the simple “stoplight” color code system on its charger: red light means no go; the pack is charging. Green light means go; the pack is charged.

With the side handle mounted and the drill/drive selector set to the “drill” position, the Milwaukee is an absolute torque monster. It's the only drill that passed both stages of my drilling test, blasting holes through lumber without the slightest hint of stalling. Although it achieved only an average score in my driving longevity test, the 2610-24's rpms didn't drop appreciatively until the pack was nearly drained.

Continues on page 56 ...



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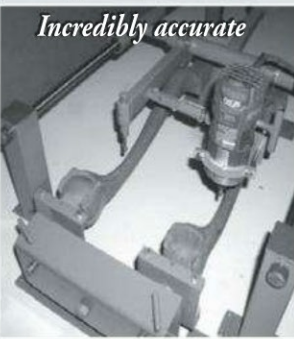
 

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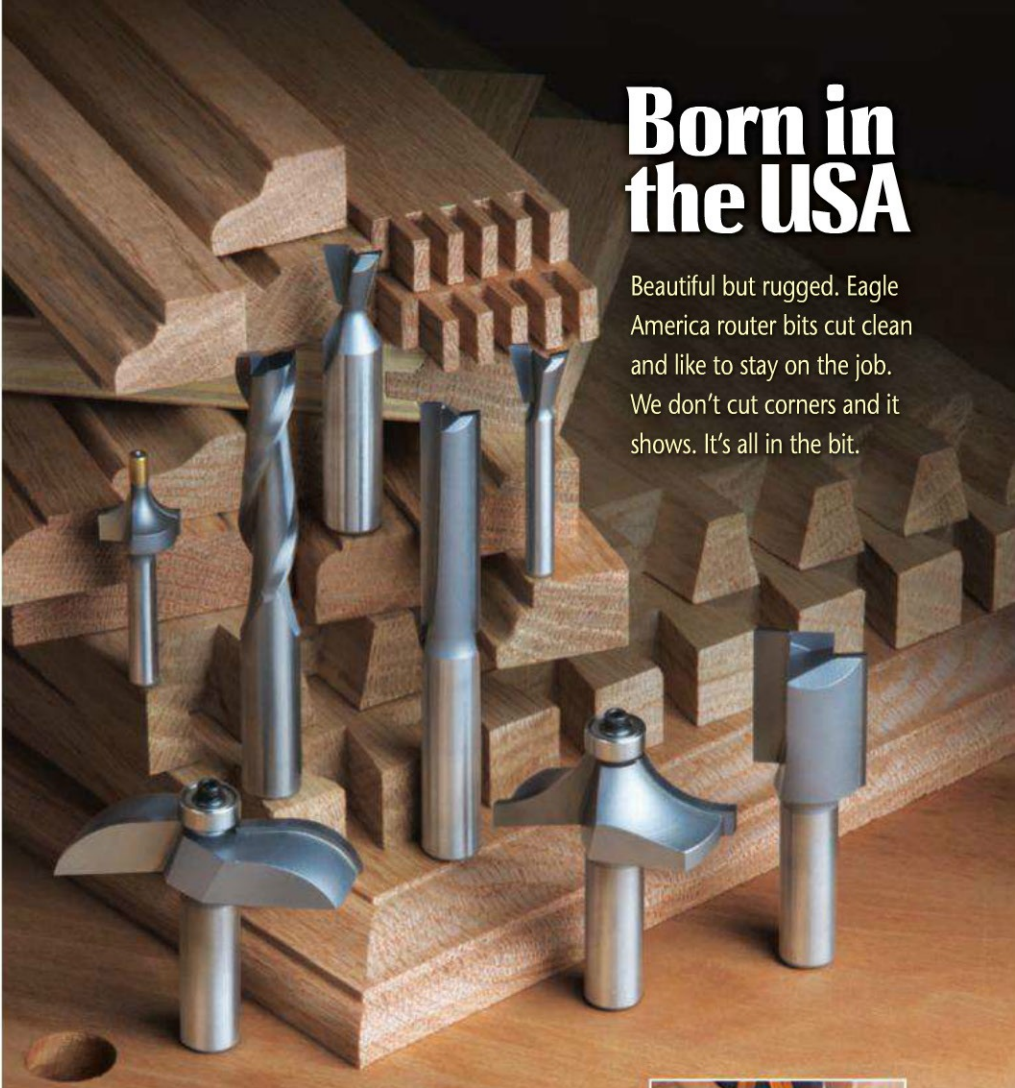
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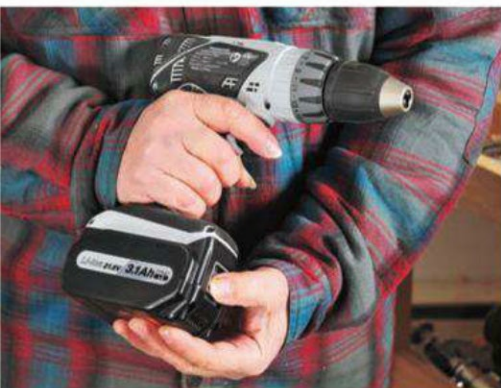
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Rated at 3.1 amp hours, the Panasonic drill's substantially sized 21.6-volt battery pack releases with a single button push.

Panasonic EY7460LZ2S

The first thing you notice about Panasonic's largest drill/driver is its enormous battery pack, that delivers 21.6 volts and has 3.1 amp hours of capacity. The pack's weight does provide some counterbalance for the large body, although the tool does

feel rather massive. All the Panasonic's controls — trigger, range selector, reversing switch — are well realized and operate smoothly.

One quirk is that when you first pull the trigger on, motor speed jumps directly from zero to 100 rpm, making it more difficult to use in some instances. The drill has a single LED light in its base, with a button switch to turn it on. It turns off automatically after 5 minutes.

Despite its slightly greater voltage, the Panasonic didn't perform very well in my drilling and driving tests. It was able to bore 1" holes

Panasonic EY7460LZ2S

Street Price: \$377

Volts: 21.6

Motor Type/Geared Trans. Range: 4 pole/2

Clutch Settings/Separate Drilling Selector: 18/No

Built-in Light?/Number of LEDs: Yes/1

Net Weight (w/ power pack): 5 lbs. 4.8 oz

Web/Phone: www.panasonic.com / 800-211-7262



using the Forstner bit, albeit sluggishly. But when I used the self-feeding auger bit, the Panasonic's electronics would simply cut power to the motor when the bit was about 1" deep. Similarly, the drill was a bit more sluggish than the other drills when driving lag bolts. The power would also occasionally cut off with the drill in reverse, when I tried backing out one of the bolts. Overall, a disappointing performance.

RIDGID R8611501K-X4

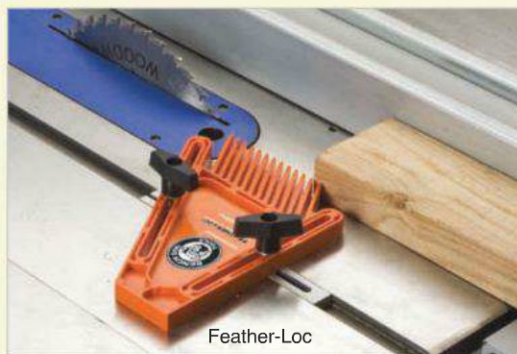
The heavy-duty R8611501K-X4 has a nice slightly-biggish grip, with textured overmold that lends confidence. Its reversing switch is well placed, but slightly stiff to operate. The RIDGID's drill/drive selector has a pair of levers that extend on opposite sides of the body just behind the clutch ring. The levers make it easier to

Continues on page 58 ...

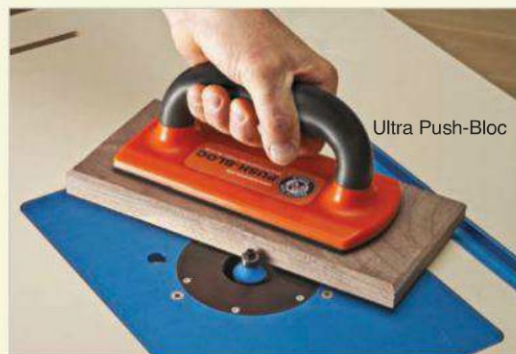


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change settings, especially when you're wearing gloves. In addition to drill and drive, there's a hammer drilling function. A pair of twin LEDs, activated via a sensor in the grip, rather than by the trigger, provided the best illumination of any drill/driver I tested.

RIDGID R8611501K-X4 Hammer Drill

Street Price: \$270

Volts: 18

Motor Type/Geared Trans. Range: 4 pole/2

Clutch Settings/Separate Drilling Selector: 24/Yes^A

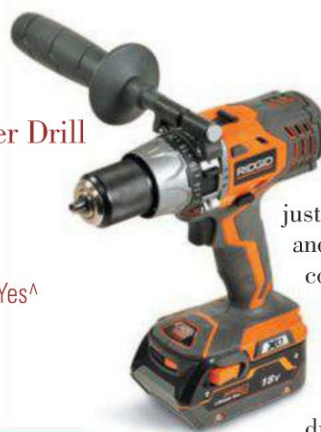
Built-in Light?/Number of LEDs: Yes/2

Net Weight (w/ power pack): 5 lbs. 4.6 oz

Web/Phone: www.ridgid.com / 800-474-3443

^A Drill selector includes hammer setting

I liked the balance and smooth overall feel. It has one of the most responsive trigger actions and is an aggressive performer with above-average scores in both my drilling power and driving longevity tests. Charger performance was second-fastest, but I noticed that this unit heated up more than most of the other drills. The rear of the motor housing got very warm to the touch, especially when it was turned on and off a lot.



feature set and are just a little more powerful and longer running than competitors. The top-scoring Festool offers cutting-edge technology and features not available on other drills. The only thing

that tarnishes its glowing performance is its top-shelf selling price. Bringing value into the mix, I have to give our "Best Bet" award to the DeWALT DCD980L2. It may lack the Festool's high-tech electronics, but it turned in top-notch scores and proved itself a venerable performer with a strong feature set and an affordable price tag.

Wrapping it Up

If I learned anything from testing drills, it's that pushing a tool to its performance limits separates the best from the merely adequate. All of these drills are capable of turning in a good day's work (although with the Panasonic, I'd hope the day isn't too long or tasks too arduous). However, at the end of the day, the two units that performed best were the Festool T18+3 and DeWALT DCD980L2. Both offer a good

Sandor Nagyszalanczy is a contributing editor to the Journal. His books are available at amazon.com.

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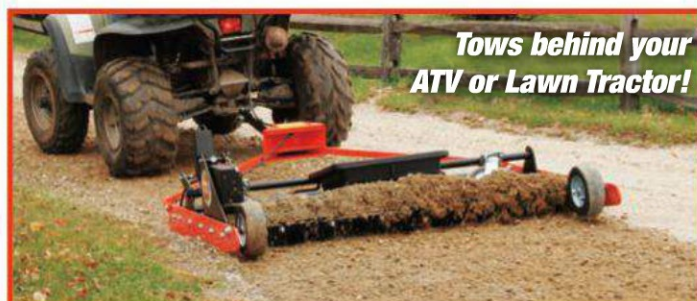


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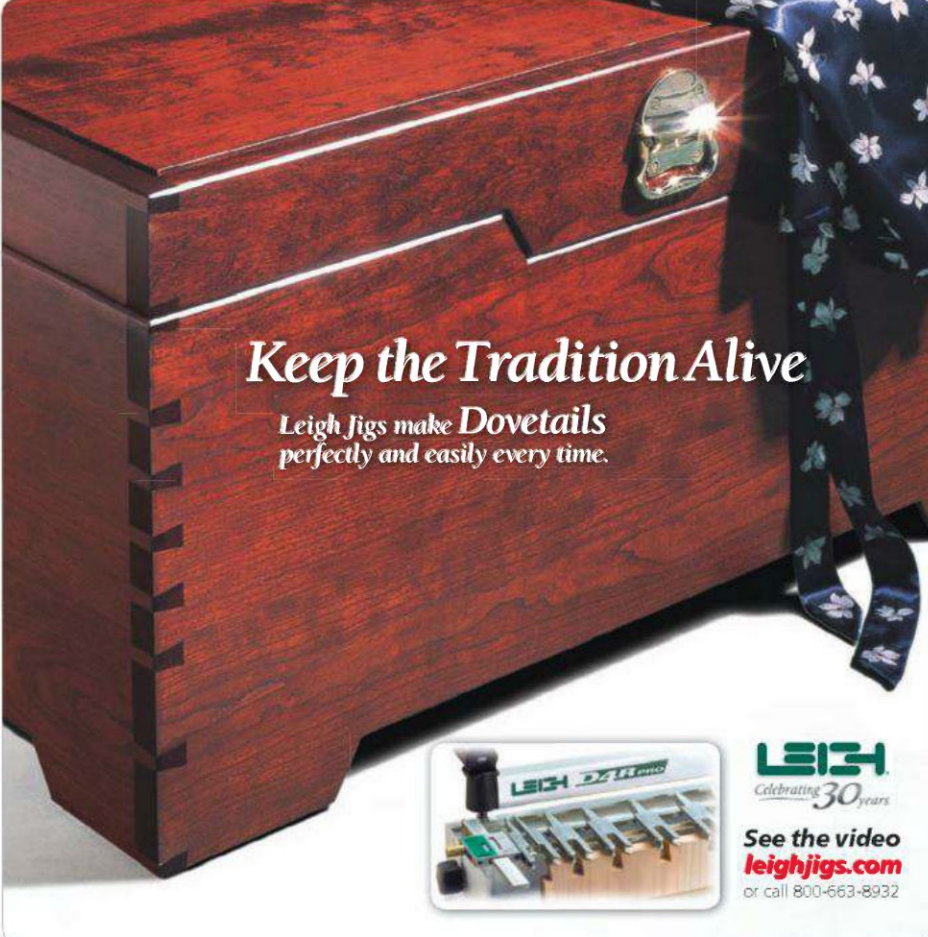
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Milwaukee's M18™ Six Pack Sequential Charger sequentially charges up to six battery packs of any Milwaukee M18 Lithium-Ion battery. Compact batteries reach a full charge in 30 minutes; extended capacity batteries take 60 minutes. The Charger includes integrated hang holes if you want to mount it vertically, and a pass-through plug to conserve outlet space. Its suggested retail price is \$99.



Milwaukee
M18 Six Pack
Sequential Charger



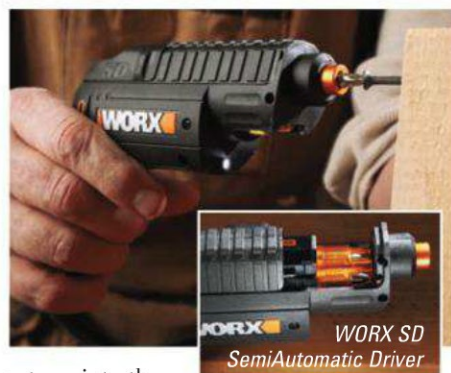
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HART Hammers

JET's new 12" *XACTA™ Saw (JTAS-12-DX)* is a workhorse with a big work surface. Weighing in at 630 pounds, the cabinet saw has a 31½" x 80" footprint that includes an 80" cast-iron table with a beveled front edge. When you're not sawing on that table, JET's director of product management for wood suggests that you could use it as a work surface for prep work or layout. Safety features of the 12" XACTA Saw include a riving knife to reduce kickback and an integrated see-through blade guard for a clear view of the material being cut. The easily reachable on/off switch provides overload protection. The saw runs on a 5hp, single-phase motor rated at 4,300 rpm and cuts with a 12" blade. The left-tilt saw has a 40½" XACTA fence and a 50" maximum rip capacity to the right of the blade and 14" to the left. It accommodates 8" dado blades up to 13/16" wide. JET's 12" XACTA Saw is priced at \$4,089.

The new **WORX® SD SemiAutomatic Driver™** has a six-slot revolving cartridge chamber that rotates screwdriver bits in and out without the need to touch the bit. You draw back the "magazine" (the cover) to advance a bit



into the chamber, then slide it forward. All six of the bits are stored within the cartridge. The WORX SD accepts 1" hex-shanked bits in slotted, Phillips, square-recess, hex or Torx styles. It has a 1/4" chuck and a no-load speed of 230 rpm. Included: SemiAutomatic Driver, two bit cartridges, 11 screwdriving kits, a screw starter drill bit for pilot holes and a 5-hour charger. The Driver is priced at \$49.99.

Rockler Woodworking and Hardware's newly redesigned *Router Tables* include bright white tables to reflect more light and maximize visibility, built-in dual T-tracks and miter tracks to expand setup possibilities with additional jigs, a 2½" dust port and a translucent bit guard for added safety and visibility. They come with adjustable fence faces and a CNC-machined aluminum plate that can fit any router and rests on a 10-point leveling/locking system. The Rockler Router Tables are available in a High Pressure Laminate Package priced at \$249.99, a Pro Phenolic Package priced at \$399.99 and a Cast Iron Package priced at \$599.99, with each package containing a table top, fence and plate.



Rockler Woodworking and Hardware's newly redesigned Router Tables



Ryobi's IntelliPort™ charger, Model Number P117, will charge any of their 18-volt ONE+ batteries, whether Lithium-Ion or NiCad, in an hour or less — with no damage to the batteries if you

leave them on the charger. The Energy Star® qualified system enters an Energy Save mode to conserve energy when it's not charging or maintaining a battery: Maintenance Mode conditions the batteries stored on the charger for peak performance. Indicator lights on the IntelliPort charger let you know if the battery is charging, defective or too hot or cold to charge. The IntelliPort charger is priced at \$29.97.

Laguna's MLA10X16-1/2-0130 Revo 10x16 Mini Lathe is a part of their new line of Revo Lathes. Made of cast-iron, the lathes in this line are powered by Servo motors. For the Revo 10x16 Mini Lathe, that motor is 1/2hp, with 110 voltage and 3 amps. It's an electronic variable speed motor with low speed of 300-900 rpm, mid speed of 600-1,800 rpm and high speed of 1,200-3,600 rpm. Laguna says that the Revo Lathes have more torque at both higher and lower rpm than other lathes, less vibration and more mass. The Revo 10x16 Mini Lathe also includes a digital readout and a poly-groove belt with a three-speed quick-change system. It has a 5" swing and a 10" turning capacity, with a maximum distance between centers of 17". The inboard faceplate measures 3⅜" with a 1" spindle, with the outboard faceplate measuring 4¼" with a 3/4" spindle. The Revo 10x16 Mini Lathe is priced at \$499.

Laguna Revo 10x16 Mini Lathe

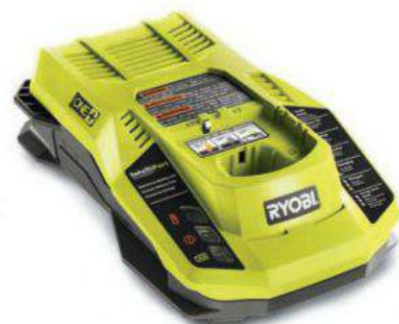


CMT's new ITK Plus™ saw blades are thin-kerf blades designed to reduce material waste and power demand on the saw while delivering industrial quality performance. The blades are made from carbide that has gone through a new process called SinterHIP ("Hot Isostatic Processing"), in which the material reaches high temperatures up to 3,500° Fahrenheit and high pressures up to 1,500 psi. The process is meant to prevent material failure and guarantee longer cutting life. The steel in the ITK Plus blades is hardened to reach 44 on the Rockwell hardness scale. Specially designed slots allow the blade to expand under heat and stress to prevent warping, and laser-cut sound dampening channels help dampen running noise and control wobbling that harmonic vibrations might cause. The non-stick orange shield coating on the blades keeps them running cool, reduces pitch buildup and protects against corrosion. A shear angle grind on the front face of the teeth produces smooth cuts, reduces cutting force and improves cutting speed. The ITK Plus blades range from 5⅝" to 12" diameter in finishing, framing and combination styles. According to CMT, retail price for the 10" diameter ITK Plus Ripping blade (item # P10024) is \$24.90.

CMT ITK Plus saw blade



NOTE: See Quik-Link at woodworkersjournal.com for web links to all of these products.



Ryobi IntelliPort charger



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Moisture Meters in the Home Shop

Looking to try lumber from a local sawmill or even cutting some of your own? Then you'll likely need to add one of these high-tech tools to your toolbox.

Have you ever thought to yourself: "It would be so much fun to cut down a tree, slice it into lumber and make something from it!"? If so, you are not alone. We've heard from many of our readers saying that going from tree to fine furniture is something they'd really like to try. Even if you are not interested in the soup-to-nuts idea, perhaps you like the concept of getting lumber from a local sawmill.

Often, the price and unique selections of local wood species found with these smaller production sawyers can deliver a real bargain. (And who does not like a bargain?) But with the great price and added enjoyment of an excursion to a non-typical lumberyard comes the must-know question: "How well is the wood seasoned?"

Water in the Wood

The bottom line is, wood needs to be properly dried to be usable — especially for fine woodworking. Just to give you an idea of how much water needs to be removed at

harvest, when a tree is newly cut down, the weight of the water in the wood can easily be equal to or greater than the weight of the wood fibers.

Small lumber producers can deliver anything from perfectly dried and ready to work stock (either air- or kiln-dried), to just sawed boards fresh out of the forest and saturated with water. (So wet, in fact, that if you run the wood through your table saw you will get sprayed as you cut!) You can also be sold lumber that is somewhere between those two extremes. So, how do you know if your wood is ready to use or not? There is only one practical way: by using a moisture meter. (You could take the lumber, stick and stack it properly somewhere dry and just wait a long time, like a year for every inch of board thickness, but you'd still be guessing — it would just be a very safe bet.) And it's a serious question, because it's not too strong a statement to say that the primary consideration in solid lumber joinery is how to deal with wood movement.

Do You Need a Meter?

If the only lumber you ever use is procured from a regular lumberyard, woodworking specialty store or a legitimate Internet wood seller, you may never need a moisture meter. But if you use lumber from a source whose drying process or effectiveness is a bit sketchy or simply unknown —



including reclaimed or found wood or boards that a friend has given you — then a moisture meter can be a real benefit in your home shop.

In general, it makes absolutely no difference if wood is air-dried or kiln-dried ... it just needs to be at its proper Moisture Content, MC. As we all know, even after a piece of wood is properly dried, its MC will still vary enough to display expansion and contraction as it adjusts to the Relative Humidity, RH, but it will never regain the amount of water it had when it was harvested.

How Do They Work?

All of the moisture meters appropriate for home shops apply a weak electric current to the wood and measure the electrical resistance they find. Wetter wood has less resistance than drier wood, and the meters calculate the MC from their findings.

There are a couple of other things that commonly affect the electrical resistance of the wood: temperature and the density of the wood. So if you are checking out the moisture content of some stock in an outdoor lumber shed in Minnesota in February, it would be useful to have a meter that adjusts for

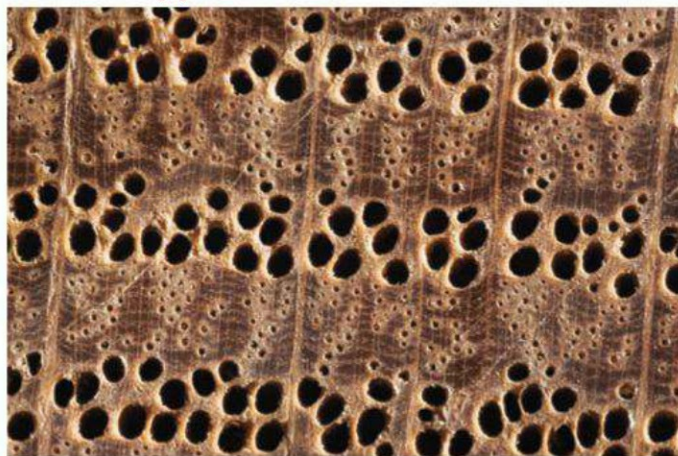
temperature — not all of them do. All of the small shop practical moisture meters make some adjustment for wood density to one degree or another. Some make very specific adjustments based on wood species, and others are simply selections of hardwood versus softwood. (Hardwood is generally more dense and softwood generally less so.)

Additionally, these moisture meters break down into two groups — those with pins and those without pins. To use the meters with pins, you simply push the pointy ends into the wood and hit a button. The electrical field will run between the pins and the meter will do its calculation. The pinless style projects a three-dimensional electric field and measures the variations within that field to calculate the MC. (Editor's note: when using a pinless moisture meter on rough-sawn lumber, it's a good practice to carry a block plane with you to smooth a small patch of wood for testing. Refer to your moisture meter's user manual for proper use instructions ... but this is a reasonable caution.)

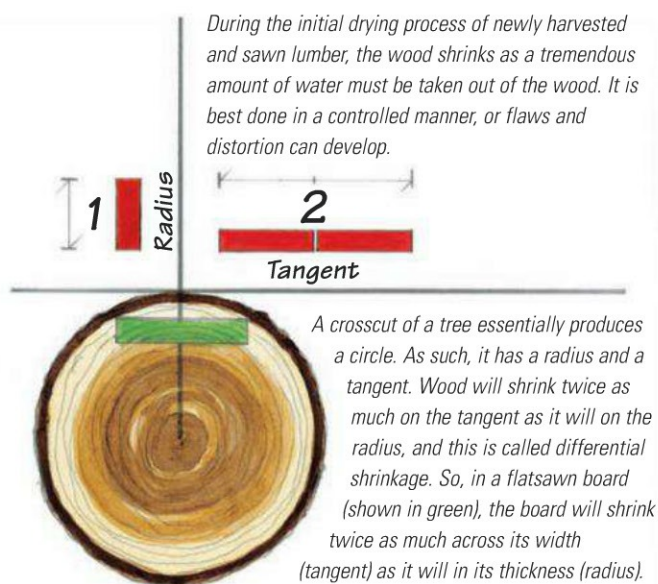
How to Use Them

Sadly, for those of us who just like to take a tool out of its box and start using it,

What Happens When the Water Leaves



By looking at this close-up photo of the end grain of red oak, it is easy to understand how water can be held in the vessels, pores and fibers of a live tree. When that water is removed, something has to give.



Flatsawn Board



Note the annual rings in this example of a flatsawn board. Here, there is more tangential exposure on the tangential face on the top of the board than on the bottom of the board. For that reason, the tissue on the top of the board will shrink more than the bottom of the board. In this instance, this board will cup as it dries.

Featured Moisture Meter Companies

Delmhorst:	877-335-6467	www.delmhorst.com
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Lignomat:	800-227-2105	www.lignomatusa.com
Wagner:	800-634-9961	www.wagnermeters.com



General MMD7NP
\$50

Delmhorst J-Lite
\$152

Lignomat Mini-Ligno ED
\$129

Wagner MMC220
\$395

A Weighty Question

How did MC calculations get done before electricity? One way was by weighing a sample of the wood before drying and then after the drying process. The formula looks like this:

$$\frac{(\text{wet sample} - \text{dry sample}) \times 100}{\text{dry sample}}$$

moisture meters require a bit of setup and some time with the instruction manual (more time with some, and less with others). At a very high level, the meters must be set for the type of wood you are testing: hardwood or softwood, and in some cases what species of wood. Then you should take a few sample readings along the board or boards — checking the MC, which is given in terms of a percentage. The ideal MC for hardwood intended for fine woodworking varies to some degree with geography — specifically in relationship to the average RH of the region. In general, hardwood should be dried to a 6 to 8% MC, which will be just right for most of the United States. In the desert Southwest, 4 to 6% is better, and in the very humid Southeastern states, 8 to 10% is an acceptable target. Softwoods are dried a few percentage points higher MC in comparison to hardwoods:

Wood Moisture at a Glance

Recommended Moisture Content for Woodworking:

- *Fine woodworking:*
 - Hardwoods 6% to 8%
 - Softwoods 10% to 12%
- *Outdoor woodworking:*
 - Hardwoods 10% to 12%
 - Softwoods 14% to 16%

Key Terminology:

- *Moisture Content:* MC (given in terms of a percentage)
- *Relative Humidity:* RH (affects dried wood's seasonal MC percentages)

10 to 12% is the ballpark (with regional adjustments for RH applying here as well). The goal is to get well-seasoned wood that will not move excessively after it has been machined into its final shape.

But with those guidelines in place, there are a few things that you might want to know. For example, if you have a project where you want to bend hardwood, using stock that is at about 25% MC will make your work much easier. You'll need to let it dry completely after bending, but you'll have fewer fractures

and an overall easier time of it at the higher MC. And if the primary use for your wood will be outdoors, then you can again stop at a higher MC ... 10 to 12% for hardwood and even higher for softwood. Once again, being able to make use of lumber at these various MC ratings is only truly possible if you know what your wood's MC is, and that requires a moisture meter of some sort. Which is just one of the reasons why they are finding themselves in more home shops every day.





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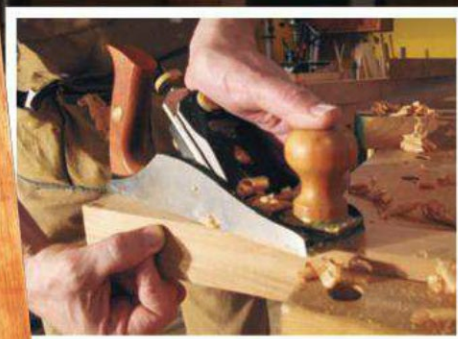
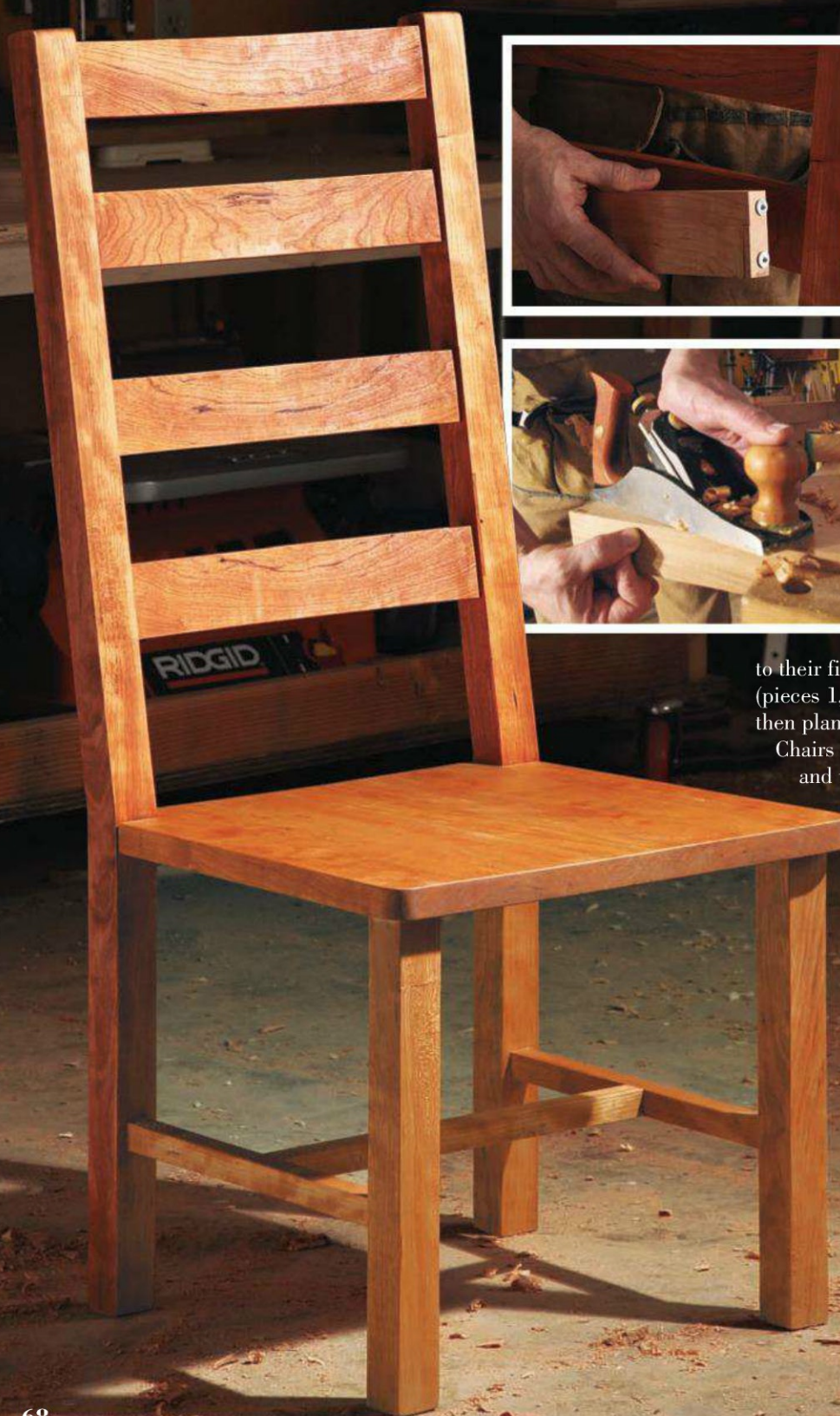


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Small Shop Journal

A Basic Ladderback Chair

Building a chair is always a challenge regardless of your shop's size. This ladderback is a classic project that will make you proud.



The construction process that you choose as a builder is often constrained not only by the size of your workplace, but by the tools that you have at your disposal. In this version of our small shop, we have no table saw, planer or jointer — with the centerpiece tool being a 14" band saw. Even so, the critical path of woodworking remains the same: harvesting the stock, marking and making the joints and so on.

To make this chair, we used solid cherry lumber surfaced to 1 $\frac{3}{4}$ ". There are no metal fasteners used here ... just dowel joints and a form of mortise-and-tenon joinery. The primary machining on this chair was done with a router guided by shop-made templates. The back legs, back slats and the seat (pieces 2, 5 and 6) were all template-routed

to their final shape. The front legs and the stretchers (pieces 1, 3 and 4) were rough cut on the band saw, then planed square and smooth by hand.

Chairs have a reputation of being difficult to build, and with good reason. As our late contributing editor Mike McGlynn used to say, "when you make a chair, the joinery has to be bomb-proof." That may have been a slight overstatement, but probably not by much!

There are a few basic techniques you'll need to use to build this chair.

- **Template routing**
- **Round tenons on square stock**
- **Dowel joints located by dowel points**
- **Hand planing legs (see photo above).**

This Small Shop...

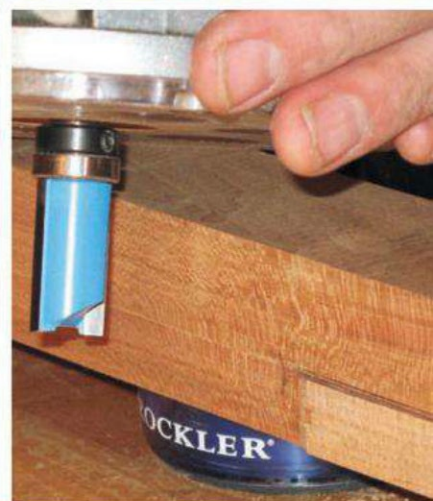
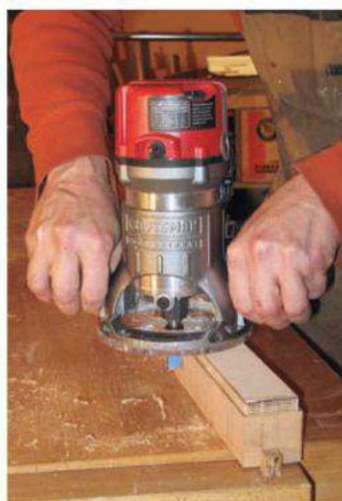
SHOP SIZE:
9' X 18'

PRIMARY TOOLS:

Band Saw
Miter Saw
Router Table
Drill Press
Handheld Router
Oscillating Belt Sander
Hand Plane
Drill/Driver

ACCESSORIES USED:

Dowel Points
Quick Grip Clamps
Bench Chisels



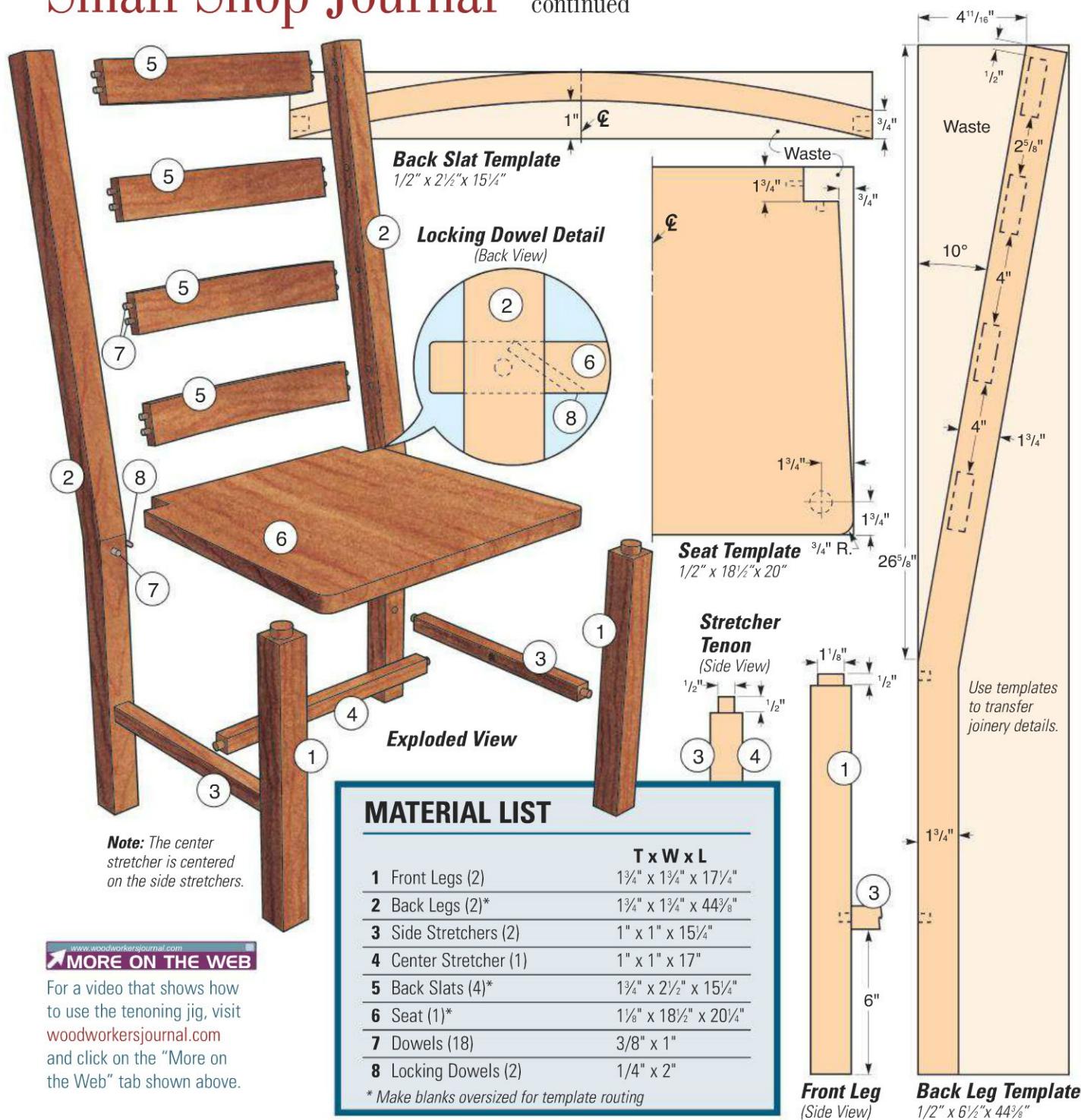
Lay out the back leg template and cut it to shape on the band saw (top photo above). Then refine the shape of the template (center photo above). Shaping the legs is a two-step routing process. First, with the template secured with carpet tape, rout the waste material away. Then remove the template and lower the bearing-guided bit to complete the shaping (lower photos above).

Getting Started

Begin the process by getting sufficient 1¾" stock into your shop to make the chair (or chairs), and keep it there for a while to let it get used to the environment. With your lumber in hand, the first task on the agenda is to make the template for the back legs, pieces 2 (top two photos at right). Because the template will end up long and skinny, Baltic birch plywood (1/2" thick) is the perfect material to use here. The voidless plywood provides strength and dimensional stability that are essential for this task. Lay out the shape of the leg on the plywood with a sharp pencil, using the *Drawings* on the following page as a guide. Then step to your band saw and cut the shape, staying just outside the pencil lines. When you've cut it out, sand and plane the excess away until you have an accurately formed template. Remember, any dips, bumps or other distortions will be clearly telegraphed to your leg stock as you rout, so refining the shape of the template is very important.

Now use the template to trace the shape of the legs onto your cherry lumber. Even though it might seem a bit odd, a full-thickness black Sharpie® is the perfect marker to use for this task. Its ultra-dark lines are easy to see, and it is thick enough that you can cut exactly to the outside of the line and have just the right amount of wood to trim away with the template-routing bit. Which brings up a couple of other important points: If you have not done much template routing, you need to be aware that routing across end grain in situations like these legs can lead to disaster. You must be very careful to avoid fracturing the grain at the corners. It is better to avoid the corners and just rout up to them but stop short, leaving small nibs of wood to be sanded off later. Also, pay attention to how the grain runs (by looking at it visually and listening while you are cutting) in the leg as you are routing. If the grain is as curly and troublesome as the cherry we used here, you will need to stop and do some climb cutting in places to avoid tearout.

The legs were routed in a two-step process because the router bit was not long enough to machine the thickness of the leg in a single pass. After securing the template to the leg blank with carpet tape, take the first routing pass. Then remove the template and lower the bit in the router. This way you can complete the



cut by guiding the bit's bearing along the surface of the wood you've already machined. You will also need to lift the leg up from the surface of your bench — we used Bench Cookies® for that task (also, clamp the leg to the bench). With that done, sand the nibs at the ends of the legs and set them aside for now.

Next, it's time to make the front legs and the stretchers (pieces 1, 3 and 4). We ripped them from the cherry lumber using the hand saw, and then used a hand plane to square and smooth them. Even with this unruly cherry, that process only took a short while. As long as you are at it, now is a good time to make the seat blank (piece 6) from 1 5/8"-thick stock. Here we resawed the thicker cherry lumber to about 1 1/4" thick, glued up the blank, then planed it flat (across the grain) with a bench plane. Make the blank slightly oversized as, once again, you will template-rout it to its exact dimensions later.

It's Jig Time

We used a shop-made jig to raise round tenons on the ends of the front legs and stretchers, pictured on the following page. It is not complicated, and one of its best features is that it can handle stock of differing thicknesses, using interchangeable tenon guides. As with any machining task, it only makes sense to use scrap lumber cut to the same dimension as the actual leg and stretcher stock to set up the cuts and test the fit of the tenons in pre-drilled holes. The stretcher tenons were formed to be 1/2" in diameter and 1/2" long. The leg tenons were also 1/2" long but 1 1/8" in diameter. One tip to keep in mind: make the tenons just oversized in diameter and then hand sand them from there. This ensures a tight fit, which is crucial for chair joints.

Small Shop Journal continues on page 72 ...

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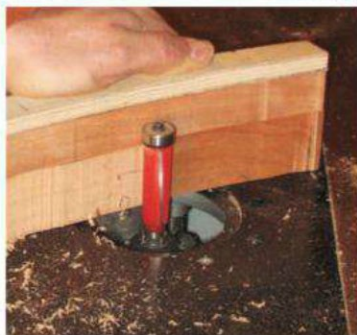
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Small Shop Journal



Dry fit the chair parts and make your slats:

The back slats are machined from 1 1/4" stock (use your template and two passes on the router table) and are secured with dowels as is traditional in ladderback chairs.

When you've cut the stretchers and legs to length and raised the tenons, go ahead and drill the holes for the stretchers in the legs and the side stretchers. Then, clamp the parts together to test the fit, and so that you can measure for the back slats (see top left photo). It's important to keep the legs parallel to each other, so using squared-up pieces of sheetstock, cut to the proper size and clamped between the legs, is a great way to do that.

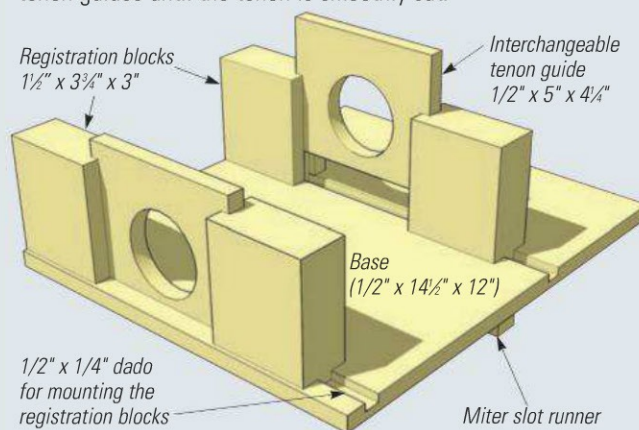
Making the Back Slats and Seat

The cross slats that make up the ladderback need to be perfectly fitted between the legs. With the chair parts clamped together, determine the slat length and create a plywood template using the *Drawings* as your guide. The back slats end up being 3/4" thick, but they are shaped from 1 1/4" stock. Once again, you will use a two-step template routing sequence, this time on the router table. Cut the slat blanks to length, use the template to trace their shape onto the blank, and then drill their ends for pairs of 3/8"-diameter dowels. Use the band saw to rough cut them to shape. Then step to your router table and chuck a 3/4" "pattern" bit — it has the bearing at the "chuck end" of the bit — into your router (photo with the blue bit above). Carefully rout the shape of the back slat, keeping your hands well clear of the cutter. When those cuts have been done, chuck a 3/4" flush-trim bit with the guide bearing on the end of the bit (photo with the red bit above). Set it so that it will clean up the rest of the waste on the slats and repeat the process. Sand the back slats smooth and then use dowel points to help locate the dowel holes in the back legs. Drill the dowel holes (we used a drill press for this) and then dry-clamp the components together. When everything fits properly, disassemble and finish-sand the parts.



Round Tenons on Square Stock

This sliding jig allows you to use a router table to raise round tenons on the ends of square stock by rotating it in the tenon guides. Tenon diameters are adjusted by raising and lowering the router bit. Tenon lengths are set by means of a stop-fence clamped over the bit. Interchangeable tenon guides accommodate different stock thicknesses. Place the stock into the jig and, with the bit turning, engage the stock with the cutter and the stop fence by sliding the jig along the miter slot. A stop clamped to the table locates the jig centered on the bit. Rotate the stock in the tenon guides until the tenon is smoothly cut.



Now it's time for your final template-routing process to complete the seat. Make a 3/4" plywood template, shaped as shown in the *Drawings* but fit precisely to the chair as it is in clamps. Secure it to the seat blank with carpet tape. Step back to your router table and use the flush-trim bit (the red bit above) to shape the blank. Take care at the end-grain corners. Square up the notches at the back of the seat with chisels. Mark the locations of the front leg mortises on the seat, and drill them. Test their fit, and then final-sand the seat. Once that's done, drill 3/8" dowel holes in the notches of the seat as shown in the *Drawings*, and use dowel points to locate matching dowel holes in the back legs. Drill those holes and test-fit the seat one more time. When you are satisfied, glue and clamp the chair together. We added 1/4" locking dowels from underneath the seat as shown in the *Drawings*. Drive them in and sand them smooth.

After the clamps came off and any glue squeeze-out was removed, we broke the edges of the chair parts with sandpaper, rounding them over to make a pleasing shape. The last task is putting a few coats of Watco® Natural oil finish on the chair and letting it cure. Now you have a fine hallway chair or, if you make a few of them, a dining room set.

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Finishing Thoughts

A Handful of Helpers

By Michael Dresdner



Gathering Your "Tools"

As shown in the photo above, the products that accumulate as you develop your finishing and touch-up skills will grow to become a significant collection. Just pick them up as you need them and store them wisely for future use.

As your woodworking skill advances, your finishing abilities will surely follow. Ideally, you'll go from applying finishes that merely cling to those that fairly sing. It's a gradual process, but this checklist may help. Here are five tools serious finishers keep close at hand.

Your Touch-up Kit

Good touch-up skills can spell the difference between inevitable mistakes and adroitly hidden ones. A wise mentor once told me "great finishers aren't flawless; they just hide their slip-ups well."

My touch-up kit contains fine 0 and 00 sable touch-up brushes, a box of powdered colors containing both pigment and dye powders, dewaxed shellac as my touch-up medium, and a piece of glass as my mixing palette. There are also several colors of putty which can be tinted to make any other color and a burn-in set, containing burn-in sticks, knives and an oven, for filling dings in the finish itself.

Colors

No matter how many cans of stain you buy, the color you want can still elude you. I keep cans of Japan colors, bottles of universal color,

and tubes of both acrylic water-based and oil-based artist's colors. The latter two are available from art supply stores. This collection allows me to mix pigment-based stains and glazes from scratch, or modify any type of stain, glaze or coating. Naturally, I also keep a range of both liquid and powdered dyes for when I need translucent color instead of opaque.

Brushes

Just as chisels and planes complement power tools, good brushes are the hand tool of the finisher. Some operations are quicker, easier, and certainly less messy when done by hand, and I don't mean simply applying clear coatings in tight spaces. Brushes allow me to create antique "dry brush" effects, blend out and feather colored glaze, selectively apply dyes and stains, and even create fake wood grain or other faux finishes.

My brush box contains black and white China bristle, ox hair blends, badger and fitch brushes, block and flap grainers (for fake wood graining), quality synthetic brushes, and pinstriping daggers and quills. Gather them little by little, as you

need, and learn to use each, and you'll be well prepared to go beyond the spray gun.

Wipers and Applicators

Cloths seem mundane, but there's more to application than random grabs from the rag bag. Admittedly, my most commonly used wiper is a blue paper shop towel, cheap and easily available at any woodworking or hardware store. On the other hand, when applying color, gels and finish, I more often reach for Scotch-Brite™ white or grey nylon abrasive pads. Then there's my box of rags, containing trace cloth, a tightly woven cotton cheesecloth material, and linen, the perfect covering for French polish pads. Finally, up on the bench there's a cup full of Q-tips®.

Rubbing-out Materials

Rubbing out a finish allows you to control the sheen instead of resolutely accepting it. Some sort of power buffer helps for gloss, along with both rubbing and polishing compounds in either liquid or solid form, and some swirl mark remover for the last step. For satin and semi-gloss, I turn to 0000 steel wool and paste wax.



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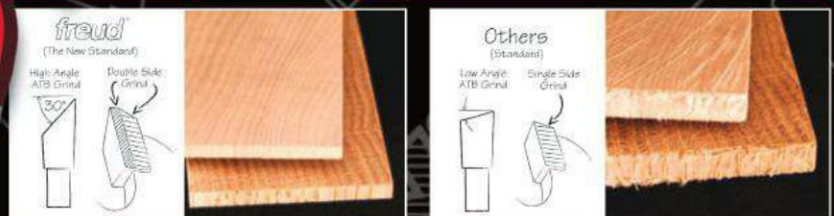
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